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(71) Applicant (*for all designated States except US*): ENVENTURE GLOBAL TECHNOLOGY [US/US]; 16200 A. Park Row, Houston, TX 77084 (US).

(72) Inventors; and

(75) Inventors/Applicants (*for US only*): BRISCO, David, Paul [US/US]; 405 Westridge Drive, Duncan, OK 73533 (US). WATSON, Brock, Wayne [US/US]; 2535 Marsh Lane #1004, Carrollton, TX 75006 (US). TREECE, Harold [US/US]; 213 Ridgecrest Drive, Duncan, OK 73533 (US).

(74) Agent: MATTINGLY, Todd; Haynes and Boone, LLP, Suite 3100, 901 Main Street, Dallas, TX 75202 (US).

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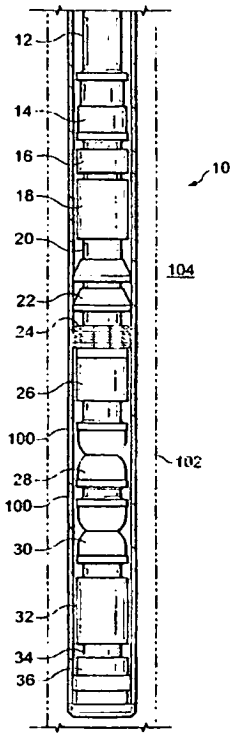
(54) Title: APPARATUS FOR RADIALLY EXPANDING AND PLASTICALLY DEFORMING A TUBULAR MEMBER

(57) Abstract: An apparatus for radially expanding and plastically deforming a tubular member.



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APPARATUS FOR RADIALLY EXPANDING AND PLASTICALLY DEFORMING A TUBULAR MEMBER

Cross Reference To Related Applications

[0001] The present application claims the benefit of the filing date of U.S. provisional patent application serial no. 60/459,776, attorney docket no. 25791.270, filed on April 2, 2003, the disclosure of which is incorporated herein by reference.

[0002] The present application is a continuation-in-part of the following: (1) PCT patent application serial number PCT/US02/36157, attorney docket number 25791.87.02, filed on 11/12/2002, (2) PCT patent application serial number PCT/US02/36267, attorney docket number 25791.88.02, filed on 11/12/2002, (3) PCT patent application serial number PCT/US03/04837, attorney docket number 25791.95.02, filed on 2/29/2003, (4) PCT patent application serial number PCT/US03/29859, attorney docket no. 25791.102.02, filed on 9/22/2003, (5) PCT patent application serial number PCT/US03/14153, attorney docket number 25791.104.02, filed on 11/13/2003, (6) PCT patent application serial number PCT/US03/18530, attorney docket number 25791.108.02, filed on 6/11/2003, (7) PCT patent application serial number PCT/US03/29858, attorney docket number 25791.112.02, (8) PCT patent application serial number PCT/US03/29460, attorney docket number 25791.114.02, filed on 9/23/2003, filed on 9/22/2003, (9) PCT patent application serial number PCT/US04/_____, attorney docket number 25791.253.02, filed on 3/11/2004, and (10) PCT patent application serial number PCT/US04/_____, attorney docket number 25791.260, filed on 3/26/2004, the disclosures of which are incorporated herein by reference.

[0003] This application is related to the following co-pending applications: (1) U.S. Patent Number 6,497,289, which was filed as U.S. Patent Application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, which claims priority from provisional application 60/111,293, filed on 12/7/98, (2) U.S. patent application serial no. 09/510,913, attorney docket no. 25791.7.02, filed on 2/23/2000, which claims priority from provisional application 60/121,702, filed on 2/25/99, (3) U.S. patent application serial no. 09/502,350, attorney docket no. 25791.8.02, filed on 2/10/2000, which claims priority from provisional application 60/119,611, filed on 2/11/99, (4) U.S. patent no. 6,328,113, which was filed as U.S. Patent Application serial number 09/440,338, attorney docket number 25791.9.02, filed on 11/15/99, which claims priority from provisional application 60/108,558, filed on 11/16/98, (5) U.S. patent application serial no. 10/169,434, attorney docket no. 25791.10.04, filed on 7/1/02, which claims priority from provisional application 60/183,546, filed on 2/18/00, (6) U.S. patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/11/99, (7) U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895,

attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (8) U.S. patent number 6,575,240, which was filed as patent application serial no. 09/511,941, attorney docket no. 25791.16.02, filed on 2/24/2000, which claims priority from provisional application 60/121,907, filed on 2/26/99, (9) U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (10) U.S. patent application serial no. 09/981,916, attorney docket no. 25791.18, filed on 10/18/01 as a continuation-in-part application of U.S. patent no. 6,328,113, which was filed as U.S. Patent Application serial number 09/440,338, attorney docket number 25791.9.02, filed on 11/15/99, which claims priority from provisional application 60/108,558, filed on 11/16/98, (11) U.S. patent number 6,604,763, which was filed as application serial no. 09/559,122, attorney docket no. 25791.23.02, filed on 4/26/2000, which claims priority from provisional application 60/131,106, filed on 4/26/99, (12) U.S. patent application serial no. 10/030,593, attorney docket no. 25791.25.08, filed on 1/8/02, which claims priority from provisional application 60/146,203, filed on 7/29/99, (13) U.S. provisional patent application serial no. 60/143,039, attorney docket no. 25791.26, filed on 7/9/99, (14) U.S. patent application serial no. 10/111,982, attorney docket no. 25791.27.08, filed on 4/30/02, which claims priority from provisional patent application serial no. 60/162,671, attorney docket no. 25791.27, filed on 11/1/1999, (15) U.S. provisional patent application serial no. 60/154,047, attorney docket no. 25791.29, filed on 9/16/1999, (16) U.S. provisional patent application serial no. 60/438,828, attorney docket no. 25791.31, filed on 1/9/03, (17) U.S. patent number 6,564,875, which was filed as application serial no. 09/679,907, attorney docket no. 25791.34.02, on 10/5/00, which claims priority from provisional patent application serial no. 60/159,082, attorney docket no. 25791.34, filed on 10/12/1999, (18) U.S. patent application serial no. 10/089,419, filed on 3/27/02, attorney docket no. 25791.36.03, which claims priority from provisional patent application serial no. 60/159,039, attorney docket no. 25791.36, filed on 10/12/1999, (19) U.S. patent application serial no. 09/679,906, filed on 10/5/00, attorney docket no. 25791.37.02, which claims priority from provisional patent application serial no. 60/159,033, attorney docket no. 25791.37, filed on 10/12/1999, (20) U.S. patent application serial no. 10/303,992, filed on 11/22/02, attorney docket no. 25791.38.07, which claims priority from provisional patent application serial no. 60/212,359, attorney docket no. 25791.38, filed on 6/19/2000, (21) U.S. provisional patent application serial no. 60/165,228, attorney docket no. 25791.39, filed on 11/12/1999, (22) U.S. provisional patent application serial no. 60/455,051, attorney docket no. 25791.40, filed on 3/14/03, (23) PCT application US02/2477, filed on 6/26/02, attorney docket no. 25791.44.02, which claims priority from U.S. provisional patent application serial no. 60/303,711, attorney docket no. 25791.44, filed on 7/6/01, (24) U.S. patent application

serial no. 10/311,412, filed on 12/12/02, attorney docket no. 25791.45.07, which claims priority from provisional patent application serial no. 60/221,443, attorney docket no. 25791.45, filed on 7/28/2000, (25) U.S. patent application serial no. 10/, filed on 12/18/02, attorney docket no. 25791.46.07, which claims priority from provisional patent application serial no. 60/221,645, attorney docket no. 25791.46, filed on 7/28/2000, (26) U.S. patent application serial no. 10/322,947, filed on 1/22/03, attorney docket no. 25791.47.03, which claims priority from provisional patent application serial no. 60/233,638, attorney docket no. 25791.47, filed on 9/18/2000, (27) U.S. patent application serial no. 10/406,648, filed on 3/31/03, attorney docket no. 25791.48.06, which claims priority from provisional patent application serial no. 60/237,334, attorney docket no. 25791.48, filed on 10/2/2000, (28) PCT application US02/04353, filed on 2/14/02, attorney docket no. 25791.50.02, which claims priority from U.S. provisional patent application serial no. 60/270,007, attorney docket no. 25791.50, filed on 2/20/2001, (29) U.S. patent application serial no. 10/465,835, filed on 6/13/03, attorney docket no. 25791.51.06, which claims priority from provisional patent application serial no. 60/262,434, attorney docket no. 25791.51, filed on 1/17/2001, (30) U.S. patent application serial no. 10/465,831, filed on 6/13/03, attorney docket no. 25791.52.06, which claims priority from U.S. provisional patent application serial no. 60/259,486, attorney docket no. 25791.52, filed on 1/3/2001, (31) U.S. provisional patent application serial no. 60/452,303, filed on 3/5/03, attorney docket no. 25791.53, (32) U.S. patent number 6,470,966, which was filed as patent application serial number 09/850,093, filed on 5/7/01, attorney docket no. 25791.55, as a divisional application of U.S. Patent Number 6,497,289, which was filed as U.S. Patent Application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, which claims priority from provisional application 60/111,293, filed on 12/7/98, (33) U.S. patent number 6,561,227, which was filed as patent application serial number 09/852,026 , filed on 5/9/01, attorney docket no. 25791.56, as a divisional application of U.S. Patent Number 6,497,289, which was filed as U.S. Patent Application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, which claims priority from provisional application 60/111,293, filed on 12/7/98, (34) U.S. patent application serial number 09/852,027, filed on 5/9/01, attorney docket no. 25791.57, as a divisional application of U.S. Patent Number 6,497,289, which was filed as U.S. Patent Application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, which claims priority from provisional application 60/111,293, filed on 12/7/98, (35) PCT Application US02/25608, attorney docket no. 25791.58.02, filed on 8/13/02, which claims priority from provisional application 60/318,021, filed on 9/7/01, attorney docket no. 25791.58, (36) PCT Application US02/24399, attorney docket no. 25791.59.02, filed on 8/1/02, which claims priority from U.S. provisional patent application serial no. 60/313,453, attorney docket no. 25791.59, filed on 8/20/2001, (37) PCT Application US02/29856, attorney docket no.

25791.60.02, filed on 9/19/02, which claims priority from U.S. provisional patent application serial no. 60/326,886, attorney docket no. 25791.60, filed on 10/3/2001, (38) PCT Application US02/20256, attorney docket no. 25791.61.02, filed on 6/26/02, which claims priority from U.S. provisional patent application serial no. 60/303,740, attorney docket no. 25791.61, filed on 7/6/2001, (39) U.S. patent application serial no. 09/962,469, filed on 9/25/01, attorney docket no. 25791.62, which is a divisional of U.S. patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/11/99, (40) U.S. patent application serial no. 09/962,470, filed on 9/25/01, attorney docket no. 25791.63, which is a divisional of U.S. patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/11/99, (41) U.S. patent application serial no. 09/962,471, filed on 9/25/01, attorney docket no. 25791.64, which is a divisional of U.S. patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/11/99, (42) U.S. patent application serial no. 09/962,467, filed on 9/25/01, attorney docket no. 25791.65, which is a divisional of U.S. patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/11/99, (43) U.S. patent application serial no. 09/962,468, filed on 9/25/01, attorney docket no. 25791.66, which is a divisional of U.S. patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/11/99, (44) PCT application US 02/25727, filed on 8/14/02, attorney docket no. 25791.67.03, which claims priority from U.S. provisional patent application serial no. 60/317,985, attorney docket no. 25791.67, filed on 9/6/2001, and U.S. provisional patent application serial no. 60/318,386, attorney docket no. 25791.67.02, filed on 9/10/2001, (45) PCT application US 02/39425, filed on 12/10/02, attorney docket no. 25791.68.02, which claims priority from U.S. provisional patent application serial no. 60/343,674 , attorney docket no. 25791.68, filed on 12/27/2001, (46) U.S. utility patent application serial no. 09/969,922, attorney docket no. 25791.69, filed on 10/3/2001, which is a continuation-in-part application of U.S. patent no. 6,328,113, which was filed as U.S. Patent Application serial number 09/440,338, attorney docket number 25791.9.02, filed on 11/15/99, which claims priority from provisional application 60/108,558, filed on 11/16/98, (47) U.S. utility patent application serial no. 10/516,467, attorney docket no. 25791.70, filed on 12/10/01, which is a continuation application of U.S. utility patent application serial no. 09/969,922, attorney docket no. 25791.69, filed on 10/3/2001, which is a continuation-in-part application of U.S. patent no. 6,328,113, which was filed as U.S. Patent Application serial number 09/440,338, attorney docket number 25791.9.02, filed on 11/15/99, which claims priority from provisional

application 60/108,558, filed on 11/16/98, (48) PCT application US 03/00609, filed on 1/9/03, attorney docket no. 25791.71.02, which claims priority from U.S. provisional patent application serial no. 60/357,372 , attorney docket no. 25791.71, filed on 2/15/02, (49) U.S. patent application serial no. 10/074,703, attorney docket no. 25791.74, filed on 2/12/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (50) U.S. patent application serial no. 10/074,244, attorney docket no. 25791.75, filed on 2/12/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (51) U.S. patent application serial no. 10/076,660, attorney docket no. 25791.76, filed on 2/15/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (52) U.S. patent application serial no. 10/076,661, attorney docket no. 25791.77, filed on 2/15/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (53) U.S. patent application serial no. 10/076,659, attorney docket no. 25791.78, filed on 2/15/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (54) U.S. patent application serial no. 10/078,928, attorney docket no. 25791.79, filed on 2/20/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (55) U.S. patent application serial no. 10/078,922, attorney docket no. 25791.80, filed on 2/20/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (56) U.S. patent application serial no. 10/078,921, attorney docket no. 25791.81, filed on 2/20/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (57) U.S. patent application serial no. 10/261,928, attorney docket no. 25791.82, filed on 10/1/02, which is a divisional of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no.

25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (58) U.S. patent application serial no. 10/079,276 , attorney docket no. 25791.83, filed on 2/20/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (59) U.S. patent application serial no. 10/262,009, attorney docket no. 25791.84, filed on 10/1/02, which is a divisional of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (60) U.S. patent application serial no. 10/092,481, attorney docket no. 25791.85, filed on 3/7/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (61) U.S. patent application serial no. 10/261,926, attorney docket no. 25791.86, filed on 10/1/02, which is a divisional of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (62) PCT application US 02/36157, filed on 11/12/02, attorney docket no. 25791.87.02, which claims priority from U.S. provisional patent application serial no. 60/338,996, attorney docket no. 25791.87, filed on 11/12/01, (63) PCT application US 02/36267, filed on 11/12/02, attorney docket no. 25791.88.02, which claims priority from U.S. provisional patent application serial no. 60/339,013, attorney docket no. 25791.88, filed on 11/12/01, (64) PCT application US 03/11765, filed on 4/16/03, attorney docket no. 25791.89.02, which claims priority from U.S. provisional patent application serial no. 60/383,917, attorney docket no. 25791.89, filed on 5/29/02, (65) PCT application US 03/15020, filed on 5/12/03, attorney docket no. 25791.90.02, which claims priority from U.S. provisional patent application serial no. 60/391,703, attorney docket no. 25791.90, filed on 6/26/02, (66) PCT application US 02/39418, filed on 12/10/02, attorney docket no. 25791.92.02, which claims priority from U.S. provisional patent application serial no. 60/346,309, attorney docket no. 25791.92, filed on 1/7/02, (67) PCT application US 03/06544, filed on 3/4/03, attorney docket no. 25791.93.02, which claims priority from U.S. provisional patent application serial no. 60/372,048, attorney docket no. 25791.93, filed on 4/12/02, (68) U.S. patent application serial no. 10/331,718, attorney docket no. 25791.94, filed on 12/30/02, which is a divisional U.S. patent application serial no. 09/679,906, filed on 10/5/00, attorney docket no. 25791.37.02, which claims priority from provisional patent application serial no. 60/159,033, attorney docket no. 25791.37, filed on 10/12/1999, (69) PCT application US 03/04837, filed on 2/29/03, attorney docket no. 25791.95.02, which claims priority from U.S. provisional patent application serial no. 60/363,829, attorney

docket no. 25791.95, filed on 3/13/02, (70) U.S. patent application serial no. 10/261,927, attorney docket no. 25791.97, filed on 10/1/02, which is a divisional of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (71) U.S. patent application serial no. 10/262,008, attorney docket no. 25791.98, filed on 10/1/02, which is a divisional of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (72) U.S. patent application serial no. 10/261,925, attorney docket no. 25791.99, filed on 10/1/02, which is a divisional of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (73) U.S. patent application serial no. 10/199,524, attorney docket no. 25791.100, filed on 7/19/02, which is a continuation of U.S. Patent Number 6,497,289, which was filed as U.S. Patent Application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, which claims priority from provisional application 60/111,293, filed on 12/7/98, (74) PCT application US 03/10144, filed on 3/28/03, attorney docket no. 25791.101.02, which claims priority from U.S. provisional patent application serial no. 60/372,632, attorney docket no. 25791.101, filed on 4/15/02, (75) U.S. provisional patent application serial no. 60/412,542, attorney docket no. 25791.102, filed on 9/20/02, (76) PCT application US 03/14153, filed on 5/6/03, attorney docket no. 25791.104.02, which claims priority from U.S. provisional patent application serial no. 60/380,147, attorney docket no. 25791.104, filed on 5/6/02, (77) PCT application US 03/19993, filed on 6/24/03, attorney docket no. 25791.106.02, which claims priority from U.S. provisional patent application serial no. 60/397,284, attorney docket no. 25791.106, filed on 7/19/02, (78) PCT application US 03/13787, filed on 5/5/03, attorney docket no. 25791.107.02, which claims priority from U.S. provisional patent application serial no. 60/387,486 , attorney docket no. 25791.107, filed on 6/10/02, (79) PCT application US 03/18530, filed on 6/11/03, attorney docket no. 25791.108.02, which claims priority from U.S. provisional patent application serial no. 60/387,961, attorney docket no. 25791.108, filed on 6/12/02, (80) PCT application US 03/20694, filed on 7/1/03, attorney docket no. 25791.110.02, which claims priority from U.S. provisional patent application serial no. 60/398,061, attorney docket no. 25791.110, filed on 7/24/02, (81) PCT application US 03/20870, filed on 7/2/03, attorney docket no. 25791.111.02, which claims priority from U.S. provisional patent application serial no. 60/399,240, attorney docket no. 25791.111, filed on 7/29/02, (82) U.S. provisional patent application serial no. 60/412,487, attorney docket no. 25791.112, filed on 9/20/02, (83) U.S. provisional patent application serial no. 60/412,488, attorney docket no. 25791.114, filed on 9/20/02, (84) U.S. patent application serial no.

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Background of the Invention

[0004] This invention relates generally to oil and gas exploration, and in particular to forming and repairing wellbore casings to facilitate oil and gas exploration.

Summary Of The Invention

[0005] According to one aspect of the present invention, an apparatus for radially expanding and plastically deforming an expandable tubular member is provided that includes a support member, a cutting device for cutting the tubular member coupled to the support member, and an expansion device for radially expanding and plastically deforming the tubular member coupled to the support member.

[0006] According to another aspect of the present invention, an apparatus for radially expanding and plastically deforming an expandable tubular member is provided that includes a support member, an expansion device for radially expanding and plastically deforming the tubular member coupled to the support member, and an actuator coupled to the support member for displacing the expansion device relative to the support member.

[0007] According to another aspect of the present invention, an apparatus for radially expanding and plastically deforming an expandable tubular member is provided that includes a support member; an expansion device for radially expanding and plastically deforming the tubular member coupled to the support member; and a sealing assembly for sealing an annulus defined between the support member and the tubular member.

[0008] According to another aspect of the present invention, an apparatus for radially expanding and plastically deforming an expandable tubular member is provided that includes a support member; a first expansion device for radially expanding and plastically deforming the tubular member coupled to the support member; and a second expansion device for radially expanding and plastically deforming the tubular member coupled to the support member.

[0009] According to another aspect of the present invention, an apparatus for radially expanding and plastically deforming an expandable tubular member is provided that includes a support member; an expansion device for radially expanding and plastically deforming the tubular member coupled to the support member; and a packer coupled to the support member.

[0010] According to another aspect of the present invention, an apparatus for radially expanding and plastically deforming an expandable tubular member is provided that includes

a support member; a cutting device for cutting the tubular member coupled to the support member; a gripping device for gripping the tubular member coupled to the support member; a sealing device for sealing an interface with the tubular member coupled to the support member; a locking device for locking the position of the tubular member relative to the support member; a first adjustable expansion device for radially expanding and plastically deforming the tubular member coupled to the support member; a second adjustable expansion device for radially expanding and plastically deforming the tubular member coupled to the support member; a packer coupled to the support member; and an actuator for displacing one or more of the sealing assembly, first and second adjustable expansion devices, and packer relative to the support member.

[0011] According to another aspect of the present invention, an apparatus for cutting a tubular member is provided that includes a support member; and a plurality of movable cutting elements coupled to the support member.

[0012] According to another aspect of the present invention, an apparatus for engaging a tubular member is provided that includes a support member; and a plurality of movable elements coupled to the support member.

[0013] According to another aspect of the present invention, an apparatus for gripping a tubular member is provided that includes a plurality of movable gripping elements.

[0014] According to another aspect of the present invention, an actuator is provided that includes a tubular housing; a tubular piston rod movably coupled to and at least partially positioned within the housing; a plurality of annular piston chambers defined by the tubular housing and the tubular piston rod; and a plurality of tubular pistons coupled to the tubular piston rod, each tubular piston movably positioned within a corresponding annular piston chamber.

[0015] According to another aspect of the present invention, an apparatus for controlling a packer is provided that includes a tubular support member; one or more drag blocks releasably coupled to the tubular support member; and a tubular stinger coupled to the tubular support member for engaging the packer.

[0016] According to another aspect of the present invention, a packer is provided that includes a support member defining a passage; a shoe comprising a float valve coupled to an end of the support member; one or more compressible packer elements movably coupled to the support member; and a sliding sleeve valve movably positioned within the passage of the support member.

[0017] According to another aspect of the present invention, a method of radially expanding and plastically deforming an expandable tubular member within a borehole having a preexisting wellbore casing is provided that includes positioning the tubular member within the borehole in overlapping relation to the wellbore casing; radially expanding

and plastically deforming a portion of the tubular member to form a bell section; and radially expanding and plastically deforming a portion of the tubular member above the bell section comprising a portion of the tubular member that overlaps with the wellbore casing; wherein the inside diameter of the bell section is greater than the inside diameter of the radially expanded and plastically deformed portion of the tubular member above the bell section.

[0018] According to another aspect of the present invention, a method for forming a mono diameter wellbore casing is provided that includes positioning an adjustable expansion device within a first expandable tubular member; supporting the first expandable tubular member and the adjustable expansion device within a borehole; lowering the adjustable expansion device out of the first expandable tubular member; increasing the outside dimension of the adjustable expansion device; displacing the adjustable expansion device upwardly relative to the first expandable tubular member m times to radially expand and plastically deform m portions of the first expandable tubular member within the borehole; positioning the adjustable expansion device within a second expandable tubular member; supporting the second expandable tubular member and the adjustable expansion device within the borehole in overlapping relation to the first expandable tubular member; lowering the adjustable expansion device out of the second expandable tubular member; increasing the outside dimension of the adjustable expansion device; and displacing the adjustable expansion device upwardly relative to the second expandable tubular member n times to radially expand and plastically deform n portions of the second expandable tubular member within the borehole.

[0019] According to another aspect of the present invention, a method for radially expanding and plastically deforming an expandable tubular member within a borehole is provided that includes positioning an adjustable expansion device within the expandable tubular member; supporting the expandable tubular member and the adjustable expansion device within the borehole; lowering the adjustable expansion device out of the expandable tubular member; increasing the outside dimension of the adjustable expansion device; displacing the adjustable expansion mandrel upwardly relative to the expandable tubular member n times to radially expand and plastically deform n portions of the expandable tubular member within the borehole; and pressurizing an interior region of the expandable tubular member above the adjustable expansion device during the radial expansion and plastic deformation of the expandable tubular member within the borehole.

[0020] According to another aspect of the present invention, a method for forming a mono diameter wellbore casing is provided that includes positioning an adjustable expansion device within a first expandable tubular member; supporting the first expandable tubular member and the adjustable expansion device within a borehole; lowering the adjustable expansion device out of the first expandable tubular member; increasing the outside

dimension of the adjustable expansion device; displacing the adjustable expansion device upwardly relative to the first expandable tubular member m times to radially expand and plastically deform m portions of the first expandable tubular member within the borehole; pressurizing an interior region of the first expandable tubular member above the adjustable expansion device during the radial expansion and plastic deformation of the first expandable tubular member within the borehole; positioning the adjustable expansion mandrel within a second expandable tubular member; supporting the second expandable tubular member and the adjustable expansion mandrel within the borehole in overlapping relation to the first expandable tubular member; lowering the adjustable expansion mandrel out of the second expandable tubular member; increasing the outside dimension of the adjustable expansion mandrel; displacing the adjustable expansion mandrel upwardly relative to the second expandable tubular member n times to radially expand and plastically deform n portions of the second expandable tubular member within the borehole; and pressurizing an interior region of the second expandable tubular member above the adjustable expansion mandrel during the radial expansion and plastic deformation of the second expandable tubular member within the borehole.

[0021] According to another aspect of the present invention, a method for radially expanding and plastically deforming an expandable tubular member within a borehole is provided that includes positioning first and second adjustable expansion devices within the expandable tubular member; supporting the expandable tubular member and the first and second adjustable expansion devices within the borehole; lowering the first adjustable expansion device out of the expandable tubular member; increasing the outside dimension of the first adjustable expansion device; displacing the first adjustable expansion device upwardly relative to the expandable tubular member to radially expand and plastically deform a lower portion of the expandable tubular member; displacing the first adjustable expansion device and the second adjustable expansion device downwardly relative to the expandable tubular member; decreasing the outside dimension of the first adjustable expansion device and increasing the outside dimension of the second adjustable expansion device; displacing the second adjustable expansion device upwardly relative to the expandable tubular member to radially expand and plastically deform portions of the expandable tubular member above the lower portion of the expandable tubular member; wherein the outside dimension of the first adjustable expansion device is greater than the outside dimension of the second adjustable expansion device.

[0022] According to another aspect of the present invention, a method for forming a mono diameter wellbore casing is provided that includes positioning first and second adjustable expansion devices within a first expandable tubular member; supporting the first expandable tubular member and the first and second adjustable expansion devices within a

borehole; lowering the first adjustable expansion device out of the first expandable tubular member; increasing the outside dimension of the first adjustable expansion device; displacing the first adjustable expansion device upwardly relative to the first expandable tubular member to radially expand and plastically deform a lower portion of the first expandable tubular member; displacing the first adjustable expansion device and the second adjustable expansion device downwardly relative to the first expandable tubular member; decreasing the outside dimension of the first adjustable expansion device and increasing the outside dimension of the second adjustable expansion device; displacing the second adjustable expansion device upwardly relative to the first expandable tubular member to radially expand and plastically deform portions of the first expandable tubular member above the lower portion of the expandable tubular member; positioning first and second adjustable expansion devices within a second expandable tubular member; supporting the first expandable tubular member and the first and second adjustable expansion devices within the borehole in overlapping relation to the first expandable tubular member; lowering the first adjustable expansion device out of the second expandable tubular member; increasing the outside dimension of the first adjustable expansion device; displacing the first adjustable expansion device upwardly relative to the second expandable tubular member to radially expand and plastically deform a lower portion of the second expandable tubular member; displacing the first adjustable expansion device and the second adjustable expansion device downwardly relative to the second expandable tubular member; decreasing the outside dimension of the first adjustable expansion device and increasing the outside dimension of the second adjustable expansion device; and displacing the second adjustable expansion device upwardly relative to the second expandable tubular member to radially expand and plastically deform portions of the second expandable tubular member above the lower portion of the second expandable tubular member; wherein the outside dimension of the first adjustable expansion device is greater than the outside dimension of the second adjustable expansion device.

[0023] According to another aspect of the present invention, a method for radially expanding and plastically deforming an expandable tubular member within a borehole is provided that includes positioning first and second adjustable expansion devices within the expandable tubular member; supporting the expandable tubular member and the first and second adjustable expansion devices within the borehole; lowering the first adjustable expansion device out of the expandable tubular member; increasing the outside dimension of the first adjustable expansion device; displacing the first adjustable expansion device upwardly relative to the expandable tubular member to radially expand and plastically deform a lower portion of the expandable tubular member; pressurizing an interior region of the expandable tubular member above the first adjustable expansion device during the radial

expansion of the lower portion of the expandable tubular member by the first adjustable expansion device; displacing the first adjustable expansion device and the second adjustable expansion device downwardly relative to the expandable tubular member; decreasing the outside dimension of the first adjustable expansion device and increasing the outside dimension of the second adjustable expansion device; displacing the second adjustable expansion device upwardly relative to the expandable tubular member to radially expand and plastically deform portions of the expandable tubular member above the lower portion of the expandable tubular member; and pressurizing an interior region of the expandable tubular member above the second adjustable expansion device during the radial expansion of the portions of the expandable tubular member above the lower portion of the expandable tubular member by the second adjustable expansion device; wherein the outside dimension of the first adjustable expansion device is greater than the outside dimension of the second adjustable expansion device.

[0024] According to another aspect of the present invention, a method for forming a mono diameter wellbore casing is provided that includes positioning first and second adjustable expansion devices within a first expandable tubular member; supporting the first expandable tubular member and the first and second adjustable expansion devices within a borehole; lowering the first adjustable expansion device out of the first expandable tubular member; increasing the outside dimension of the first adjustable expansion device; displacing the first adjustable expansion device upwardly relative to the first expandable tubular member to radially expand and plastically deform a lower portion of the first expandable tubular member; pressurizing an interior region of the first expandable tubular member above the first adjustable expansion device during the radial expansion of the lower portion of the first expandable tubular member by the first adjustable expansion device; displacing the first adjustable expansion device and the second adjustable expansion device downwardly relative to the first expandable tubular member; decreasing the outside dimension of the first adjustable expansion device and increasing the outside dimension of the second adjustable expansion device; displacing the second adjustable expansion device upwardly relative to the first expandable tubular member to radially expand and plastically deform portions of the first expandable tubular member above the lower portion of the expandable tubular member; pressurizing an interior region of the first expandable tubular member above the second adjustable expansion device during the radial expansion of the portions of the first expandable tubular member above the lower portion of the first expandable tubular member by the second adjustable expansion device; positioning first and second adjustable expansion devices within a second expandable tubular member; supporting the first expandable tubular member and the first and second adjustable expansion devices within the borehole in overlapping relation to the first expandable tubular

member; lowering the first adjustable expansion device out of the second expandable tubular member; increasing the outside dimension of the first adjustable expansion device; displacing the first adjustable expansion device upwardly relative to the second expandable tubular member to radially expand and plastically deform a lower portion of the second expandable tubular member; pressurizing an interior region of the second expandable tubular member above the first adjustable expansion device during the radial expansion of the lower portion of the second expandable tubular member by the first adjustable expansion device; displacing the first adjustable expansion device and the second adjustable expansion device downwardly relative to the second expandable tubular member; decreasing the outside dimension of the first adjustable expansion device and increasing the outside dimension of the second adjustable expansion device; displacing the second adjustable expansion device upwardly relative to the second expandable tubular member to radially expand and plastically deform portions of the second expandable tubular member above the lower portion of the second expandable tubular member; and pressurizing an interior region of the second expandable tubular member above the second adjustable expansion device during the radial expansion of the portions of the second expandable tubular member above the lower portion of the second expandable tubular member by the second adjustable expansion device; wherein the outside dimension of the first adjustable expansion device is greater than the outside dimension of the second adjustable expansion device.

[0025] According to another aspect of the present invention, a method for radially expanding and plastically deforming an expandable tubular member within a borehole is provided that includes supporting the expandable tubular member, an hydraulic actuator, and an adjustable expansion device within the borehole; increasing the size of the adjustable expansion device; and displacing the adjustable expansion device upwardly relative to the expandable tubular member using the hydraulic actuator to radially expand and plastically deform a portion of the expandable tubular member.

[0026] According to another aspect of the present invention, a method for forming a mono diameter wellbore casing within a borehole that includes a preexisting wellbore casing is provided that includes supporting the expandable tubular member, an hydraulic actuator, and an adjustable expansion device within the borehole; increasing the size of the adjustable expansion device; displacing the adjustable expansion device upwardly relative to the expandable tubular member using the hydraulic actuator to radially expand and plastically deform a portion of the expandable tubular member; and displacing the adjustable expansion device upwardly relative to the expandable tubular member to radially expand and plastically deform the remaining portion of the expandable tubular member and a portion of the preexisting wellbore casing that overlaps with an end of the remaining portion of the

expandable tubular member.

[0027] According to another aspect of the present invention, a method of radially expanding and plastically deforming a tubular member is provided that includes positioning the tubular member within a preexisting structure; radially expanding and plastically deforming a lower portion of the tubular member to form a bell section; and radially expanding and plastically deforming a portion of the tubular member above the bell section.

[0028] According to another aspect of the present invention, a method of radially expanding and plastically deforming a tubular member is provided that includes applying internal pressure to the inside surface of the tubular member at a plurality of discrete location separated from one another.

[0029] According to another aspect of the present invention, a system for radially expanding and plastically deforming an expandable tubular member within a borehole having a preexisting wellbore casing is provided that includes means for positioning the tubular member within the borehole in overlapping relation to the wellbore casing; means for radially expanding and plastically deforming a portion of the tubular member to form a bell section; and means for radially expanding and plastically deforming a portion of the tubular member above the bell section comprising a portion of the tubular member that overlaps with the wellbore casing; wherein the inside diameter of the bell section is greater than the inside diameter of the radially expanded and plastically deformed portion of the tubular member above the bell section.

[0030] According to another aspect of the present invention, a system for forming a mono diameter wellbore casing is provided that includes means for positioning an adjustable expansion device within a first expandable tubular member; means for supporting the first expandable tubular member and the adjustable expansion device within a borehole; means for lowering the adjustable expansion device out of the first expandable tubular member; means for increasing the outside dimension of the adjustable expansion device; means for displacing the adjustable expansion device upwardly relative to the first expandable tubular member m times to radially expand and plastically deform m portions of the first expandable tubular member within the borehole; means for positioning the adjustable expansion device within a second expandable tubular member; means for supporting the second expandable tubular member and the adjustable expansion device within the borehole in overlapping relation to the first expandable tubular member; means for lowering the adjustable expansion device out of the second expandable tubular member; means for increasing the outside dimension of the adjustable expansion device; and means for displacing the adjustable expansion device upwardly relative to the second expandable tubular member n times to radially expand and plastically deform n portions of the second expandable tubular member within the borehole.

[0031] According to another aspect of the present invention, a system for radially expanding and plastically deforming an expandable tubular member within a borehole is provided that includes means for positioning an adjustable expansion device within the expandable tubular member; means for supporting the expandable tubular member and the adjustable expansion device within the borehole; means for lowering the adjustable expansion device out of the expandable tubular member; means for increasing the outside dimension of the adjustable expansion device; means for displacing the adjustable expansion mandrel upwardly relative to the expandable tubular member n times to radially expand and plastically deform n portions of the expandable tubular member within the borehole; and means for pressurizing an interior region of the expandable tubular member above the adjustable expansion device during the radial expansion and plastic deformation of the expandable tubular member within the borehole.

[0032] According to another aspect of the present invention, a system for forming a mono diameter wellbore casing is provided that includes means for positioning an adjustable expansion device within a first expandable tubular member; means for supporting the first expandable tubular member and the adjustable expansion device within a borehole; means for lowering the adjustable expansion device out of the first expandable tubular member; means for increasing the outside dimension of the adjustable expansion device; means for displacing the adjustable expansion device upwardly relative to the first expandable tubular member m times to radially expand and plastically deform m portions of the first expandable tubular member within the borehole; means for pressurizing an interior region of the first expandable tubular member above the adjustable expansion device during the radial expansion and plastic deformation of the first expandable tubular member within the borehole; means for positioning the adjustable expansion mandrel within a second expandable tubular member; means for supporting the second expandable tubular member and the adjustable expansion mandrel within the borehole in overlapping relation to the first expandable tubular member; means for lowering the adjustable expansion mandrel out of the second expandable tubular member; means for increasing the outside dimension of the adjustable expansion mandrel; means for displacing the adjustable expansion mandrel upwardly relative to the second expandable tubular member n times to radially expand and plastically deform n portions of the second expandable tubular member within the borehole; and means for pressurizing an interior region of the second expandable tubular member above the adjustable expansion mandrel during the radial expansion and plastic deformation of the second expandable tubular member within the borehole.

[0033] According to another aspect of the present invention, a system for radially expanding and plastically deforming an expandable tubular member within a borehole is provided that includes means for positioning first and second adjustable expansion devices

within the expandable tubular member; means for supporting the expandable tubular member and the first and second adjustable expansion devices within the borehole; means for lowering the first adjustable expansion device out of the expandable tubular member; means for increasing the outside dimension of the first adjustable expansion device; means for displacing the first adjustable expansion device upwardly relative to the expandable tubular member to radially expand and plastically deform a lower portion of the expandable tubular member; means for displacing the first adjustable expansion device and the second adjustable expansion device downwardly relative to the expandable tubular member; means for decreasing the outside dimension of the first adjustable expansion device and increasing the outside dimension of the second adjustable expansion device; means for displacing the second adjustable expansion device upwardly relative to the expandable tubular member to radially expand and plastically deform portions of the expandable tubular member above the lower portion of the expandable tubular member; wherein the outside dimension of the first adjustable expansion device is greater than the outside dimension of the second adjustable expansion device.

[0034] According to another aspect of the present invention, a system for forming a mono diameter wellbore casing is provided that includes means for positioning first and second adjustable expansion devices within a first expandable tubular member; means for supporting the first expandable tubular member and the first and second adjustable expansion devices within a borehole; means for lowering the first adjustable expansion device out of the first expandable tubular member; means for increasing the outside dimension of the first adjustable expansion device; displacing the first adjustable expansion device upwardly relative to the first expandable tubular member to radially expand and plastically deform a lower portion of the first expandable tubular member; means for displacing the first adjustable expansion device and the second adjustable expansion device downwardly relative to the first expandable tubular member; means for decreasing the outside dimension of the first adjustable expansion device and increasing the outside dimension of the second adjustable expansion device; means for displacing the second adjustable expansion device upwardly relative to the first expandable tubular member to radially expand and plastically deform portions of the first expandable tubular member above the lower portion of the expandable tubular member; means for positioning first and second adjustable expansion devices within a second expandable tubular member; means for supporting the first expandable tubular member and the first and second adjustable expansion devices within the borehole in overlapping relation to the first expandable tubular member; means for lowering the first adjustable expansion device out of the second expandable tubular member; means for increasing the outside dimension of the first adjustable expansion device; means for displacing the adjustable expansion device

upwardly relative to the second expandable tubular member to radially expand and plastically deform a lower portion of the second expandable tubular member; means for displacing the first adjustable expansion device and the second adjustable expansion device downwardly relative to the second expandable tubular member; means for decreasing the outside dimension of the first adjustable expansion device and increasing the outside dimension of the second adjustable expansion device; and means for displacing the second adjustable expansion device upwardly relative to the second expandable tubular member to radially expand and plastically deform portions of the second expandable tubular member above the lower portion of the second expandable tubular member; wherein the outside dimension of the first adjustable expansion device is greater than the outside dimension of the second adjustable expansion device.

[0035] According to another aspect of the present invention, a system for radially expanding and plastically deforming an expandable tubular member within a borehole is provided that includes means for positioning first and second adjustable expansion devices within the expandable tubular member; means for supporting the expandable tubular member and the first and second adjustable expansion devices within the borehole; means for lowering the first adjustable expansion device out of the expandable tubular member; means for increasing the outside dimension of the first adjustable expansion device; means for displacing the first adjustable expansion device upwardly relative to the expandable tubular member to radially expand and plastically deform a lower portion of the expandable tubular member; means for pressurizing an interior region of the expandable tubular member above the first adjustable expansion device during the radial expansion of the lower portion of the expandable tubular member by the first adjustable expansion device; means for displacing the first adjustable expansion device and the second adjustable expansion device downwardly relative to the expandable tubular member; means for decreasing the outside dimension of the first adjustable expansion device and increasing the outside dimension of the second adjustable expansion device; means for displacing the second adjustable expansion device upwardly relative to the expandable tubular member to radially expand and plastically deform portions of the expandable tubular member above the lower portion of the expandable tubular member; and means for pressurizing an interior region of the expandable tubular member above the second adjustable expansion device during the radial expansion of the portions of the expandable tubular member above the lower portion of the expandable tubular member by the second adjustable expansion device; wherein the outside dimension of the first adjustable expansion device is greater than the outside dimension of the second adjustable expansion device.

[0036] According to another aspect of the present invention, a system for forming a mono diameter wellbore casing is provided that includes means for positioning first and

second adjustable expansion devices within a first expandable tubular member; means for supporting the first expandable tubular member and the first and second adjustable expansion devices within a borehole; means for lowering the first adjustable expansion device out of the first expandable tubular member; means for increasing the outside dimension of the first adjustable expansion device; means for displacing the first adjustable expansion device upwardly relative to the first expandable tubular member to radially expand and plastically deform a lower portion of the first expandable tubular member; means for pressurizing an interior region of the first expandable tubular member above the first adjustable expansion device during the radial expansion of the lower portion of the first expandable tubular member by the first adjustable expansion device; means for displacing the first adjustable expansion device and the second adjustable expansion device downwardly relative to the first expandable tubular member; means for decreasing the outside dimension of the first adjustable expansion device and increasing the outside dimension of the second adjustable expansion device; means for displacing the second adjustable expansion device upwardly relative to the first expandable tubular member to radially expand and plastically deform portions of the first expandable tubular member above the lower portion of the expandable tubular member; means for pressurizing an interior region of the first expandable tubular member above the second adjustable expansion device during the radial expansion of the portions of the first expandable tubular member above the lower portion of the first expandable tubular member by the second adjustable expansion device; means for positioning first and second adjustable expansion devices within a second expandable tubular member; means for supporting the first expandable tubular member and the first and second adjustable expansion devices within the borehole in overlapping relation to the first expandable tubular member; means for lowering the first adjustable expansion device out of the second expandable tubular member; means for increasing the outside dimension of the first adjustable expansion device; means for displacing the first adjustable expansion device upwardly relative to the second expandable tubular member to radially expand and plastically deform a lower portion of the second expandable tubular member; means for pressurizing an interior region of the second expandable tubular member above the first adjustable expansion device during the radial expansion of the lower portion of the second expandable tubular member by the first adjustable expansion device; means for displacing the first adjustable expansion device and the second adjustable expansion device downwardly relative to the second expandable tubular member; means for decreasing the outside dimension of the first adjustable expansion device and increasing the outside dimension of the second adjustable expansion device; means for displacing the second adjustable expansion device upwardly relative to the second expandable tubular member to radially expand and plastically deform portions of

the second expandable tubular member above the lower portion of the second expandable tubular member; and means for pressurizing an interior region of the second expandable tubular member above the second adjustable expansion device during the radial expansion of the portions of the second expandable tubular member above the lower portion of the second expandable tubular member by the second adjustable expansion device; wherein the outside dimension of the first adjustable expansion device is greater than the outside dimension of the second adjustable expansion device.

[0037] According to another aspect of the present invention, a system for radially expanding and plastically deforming an expandable tubular member within a borehole is provided that includes means for supporting the expandable tubular member, an hydraulic actuator, and an adjustable expansion device within the borehole; means for increasing the size of the adjustable expansion device; and means for displacing the adjustable expansion device upwardly relative to the expandable tubular member using the hydraulic actuator to radially expand and plastically deform a portion of the expandable tubular member.

[0038] According to another aspect of the present invention, a system for forming a mono diameter wellbore casing within a borehole that includes a preexisting wellbore casing is provided that includes means for supporting the expandable tubular member, an hydraulic actuator, and an adjustable expansion device within the borehole; means for increasing the size of the adjustable expansion device; means for displacing the adjustable expansion device upwardly relative to the expandable tubular member using the hydraulic actuator to radially expand and plastically deform a portion of the expandable tubular member; and means for displacing the adjustable expansion device upwardly relative to the expandable tubular member to radially expand and plastically deform the remaining portion of the expandable tubular member and a portion of the preexisting wellbore casing that overlaps with an end of the remaining portion of the expandable tubular member.

[0039] According to another aspect of the present invention, a system for radially expanding and plastically deforming a tubular member is provided that includes means for positioning the tubular member within a preexisting structure; means for radially expanding and plastically deforming a lower portion of the tubular member to form a bell section; and means for radially expanding and plastically deforming a portion of the tubular member above the bell section.

[0040] According to another aspect of the present invention, a system of radially expanding and plastically deforming a tubular member is provided that includes a support member; and means for applying internal pressure to the inside surface of the tubular member at a plurality of discrete location separated from one another coupled to the support member.

[0041] According to another aspect of the present invention, a method of cutting a tubular member is provided that includes positioning a plurality of cutting elements within the tubular member; and bringing the cutting elements into engagement with the tubular member.

[0042] According to another aspect of the present invention, a method of gripping a tubular member is provided that includes positioning a plurality of gripping elements within the tubular member; bringing the gripping elements into engagement with the tubular member. In an exemplary embodiment, bringing the gripping elements into engagement with the tubular member includes displacing the gripping elements in an axial direction; and displacing the gripping elements in a radial direction.

[0043] According to another aspect of the present invention, a method of operating an actuator is provided that includes pressurizing a plurality of pressure chamber.

[0044] According to another aspect of the present invention, a method of injecting a hardenable fluidic sealing material into an annulus between a tubular member and a preexisting structure is provided that includes positioning the tubular member into the preexisting structure; sealing off an end of the tubular member; operating a valve within the end of the tubular member; and injecting a hardenable fluidic sealing material through the valve into the annulus between the tubular member and the preexisting structure.

[0045] According to another aspect of the present invention, a system for cutting a tubular member is provided that includes means for positioning a plurality of cutting elements within the tubular member; and means for bringing the cutting elements into engagement with the tubular member.

[0046] According to another aspect of the present invention, a system for gripping a tubular member is provided that includes means for positioning a plurality of gripping elements within the tubular member; and means for bringing the gripping elements into engagement with the tubular member.

[0047] According to another aspect of the present invention, an actuator system is provided that includes a support member; and means for pressurizing a plurality of pressure chambers coupled to the support member. In an exemplary embodiment, the system further includes means for transmitting torsional loads.

[0048] According to another aspect of the present invention, a system for injecting a hardenable fluidic sealing material into an annulus between a tubular member and a preexisting structure is provided that includes means for positioning the tubular member into the preexisting structure; means for sealing off an end of the tubular member; means for operating a valve within the end of the tubular member; and means for injecting a hardenable fluidic sealing material through the valve into the annulus between the tubular member and the preexisting structure.

[0049] According to another aspect of the present invention, a method of engaging a tubular member is provided that includes positioning a plurality of elements within the tubular member; and bringing the elements into engagement with the tubular member.

[0050] According to another aspect of the present invention, a system for engaging a tubular member is provided that includes means for positioning a plurality of elements within the tubular member; and means for bringing the elements into engagement with the tubular member. In an exemplary embodiment, the elements include a first group of elements; and a second group of elements; wherein the first group of elements are interleaved with the second group of elements.

Brief Description of the Drawings

[0051] Fig. 1 is a fragmentary cross-sectional illustration of an embodiment of a system for radially expanding and plastically deforming wellbore casing, including a tubular support member, a casing cutter, a ball gripper for gripping a wellbore casing, a force multiplier tension actuator, a safety sub, a cup sub, a casing lock, an extension actuator, a bell section adjustable expansion cone assembly, a casing section adjustable expansion cone assembly, a packer setting tool, a packer, a stinger, and an expandable wellbore casing, during the placement of the system within a wellbore.

[0052] Fig. 2 is a fragmentary cross-sectional illustration of the system of Fig. 1 during the subsequent displacement of the bell section adjustable expansion cone assembly, the casing section adjustable expansion cone assembly, the packer setting tool, the packer, and the stinger downwardly out of the end of the expandable wellbore casing and the expansion of the size of the bell section adjustable expansion cone assembly and the casing section adjustable expansion cone assembly.

[0053] Fig. 3 is a fragmentary cross-sectional illustration of the system of Fig. 2 during the subsequent operation of the tension actuator to displace the bell section adjustable expansion cone assembly upwardly into the end of the expandable wellbore casing to form a bell section in the end of the expandable wellbore casing.

[0054] Fig. 4 is a fragmentary cross-sectional illustration of the system of Fig. 3 during the subsequent reduction of the bell section adjustable expansion cone assembly.

[0055] Fig. 5 is a fragmentary cross-sectional illustration of the system of Fig. 4 during the subsequent upward displacement of the expanded casing section adjustable expansion cone assembly to radially expand the expandable wellbore casing.

[0056] Fig. 6 is a fragmentary cross-sectional illustration of the system of Fig. 5 during the subsequent lowering of the tubular support member, casing cutter, ball gripper, a force multiplier tension actuator, safety sub, cup sub, casing lock, extension actuator, bell section adjustable expansion cone assembly, casing section adjustable expansion cone assembly,

packer setting tool, packer, and stinger and subsequent setting of the packer within the expandable wellbore casing above the bell section.

[0057] Fig. 7 is a fragmentary cross-sectional illustration of the system of Fig. 6 during the subsequent injection of fluidic materials into the system to displace the expanded casing section adjustable expansion cone assembly upwardly through the expandable wellbore casing to radially expand and plastically deform the expandable wellbore casing.

[0058] Fig. 8 is a fragmentary cross-sectional illustration of the system of Fig. 7 during the subsequent injection of fluidic materials into the system to displace the expanded casing section adjustable expansion cone assembly upwardly through the expandable wellbore casing and a surrounding preexisting wellbore casing to radially expand and plastically deform the overlapping expandable wellbore casing and the surrounding preexisting wellbore casing.

[0059] Fig. 9 is a fragmentary cross-sectional illustration of the system of Fig. 8 during the subsequent operation of the casing cutter to cut off an end of the expandable wellbore casing.

[0060] Fig. 10 is a fragmentary cross-sectional illustration of the system of Fig. 9 during the subsequent removal of the cut off end of the expandable wellbore casing.

[0061] Figs. 11-1 and 11-2, 11A1 to 11A2, 11B1 to 11B2, 11C, 11D, 11E, 11F, 11G, 11H, 11I, 11j, 11K, 11L, 11M, 11N, 11O, 11P, 11Q, 11R, 11S, 11T, 11U, 11V, 11W, 11X, 11Y, 11Z1 to 11Z4, 11AA1 to 11AA4, 11AB1 to 11AB4, 11AC1 to 11AC4, 11AD, and 11AE are fragmentary cross-sectional and perspective illustrations of an exemplary embodiment of a casing cutter assembly.

[0062] Figs. 12A1 to 12A4 and 12C1 to 12C4 are fragmentary cross-sectional illustrations of an exemplary embodiment of a ball gripper assembly.

[0063] Fig. 12B is a top view of a portion of the ball gripper assembly of Figs. 12A1 to 12A4 and 12C1 to 12C4.

[0064] Figs. 13A1 to 13A8 and 13B1 to 13B7 are fragmentary cross-sectional illustrations of an exemplary embodiment of a tension actuator assembly.

[0065] Fig. 14A is a fragmentary cross-sectional illustrations of an exemplary embodiment of a safety sub assembly.

[0066] Figs. 14A, 14B and 14C are fragmentary cross-sectional and perspective illustrations of an exemplary embodiment of a cup seal assembly.

[0067] Figs. 15-1 and 15-2, 15A1 to 15A2, 15B1 to 15B2, 15C, 15D, 15E, 15F, 15G, 15H, 15I, 15j, 15K, 15L, 15M, 15N, 15O, 15P, 15R, 15S, 15T, 15U, 15V, 15W, 15X, 15Y, 15Z1 to 15Z4, 15AA1 to 15AA4, 15AB1 to 15AB4, 15AC1 to 15AC4, 15AD, and 15AE are fragmentary cross-sectional and perspective illustrations of an exemplary embodiment of an adjustable bell section expansion cone assembly.

[0068] Figs. 16-1 and 16-2, 16A1 to 16A2, 16B1 to 16B2, 16C, 16D, 16E, 16F, 16G, 16H, 16I, 16j, 16K, 16L, 16M, 16N, 16O, 16P, 16R, 16S, 16T, 16U, 16V, 16W, 16X, 16Y, 16Z1-16Z4, 16AA1 to 16AA4, 16AB1 to 16AB4, 16AC1 to 16AC4, 16AD, and 16AE are fragmentary cross-sectional and perspective illustrations of an exemplary embodiment of an adjustable casing expansion cone assembly.

[0069] Figs. 17A to 17C is a fragmentary cross-sectional illustration of an exemplary embodiment of a packer setting tool assembly.

[0070] Figs. 18-1 to 18-5 is a fragmentary cross-sectional illustration of an exemplary embodiment of a packer assembly.

[0071] Figs. 19A1 to 19A5, 19B1 to 19B5, 19C1 to 19C5, 19D1 to 19D5, 19E1 to 19E6, 19F1 to 19F6, 19G1 to 19G6, and 19H1 to 19H5, are fragmentary cross-sectional illustrations of an exemplary embodiment of the operation of the packer setting tool and the packer assembly of Figs. 17A to 17C and 18-1 to 18-5.

[0072] Figs. 20 and 20A to 20AX are fragmentary perspective and cross-sectional illustrations of an alternative embodiment of the packer assembly.

Detailed Description of the Illustrative Embodiments

[0073] Referring initially to Figs. 1-10, an exemplary embodiment of a system 10 for radially expanding and plastically deforming a wellbore casing includes a conventional tubular support 12 having an end that is coupled to an end of a casing cutter assembly 14. In an exemplary embodiment, the casing cutter assembly 14 may be, or may include elements, of one or more conventional commercially available casing cutters for cutting wellbore casing, or equivalents thereof.

[0074] An end of a ball gripper assembly 16 is coupled to another end of the casing cutter assembly 14. In an exemplary embodiment, the ball gripper assembly 14 may be, or may include elements, of one or more conventional commercially available ball grippers, or other types of gripping devices, for gripping wellbore casing, or equivalents thereof.

[0075] An end of a tension actuator assembly 18 is coupled to another end of the ball gripper assembly 16. In an exemplary embodiment, the tension actuator assembly 18 may be, or may include elements, of one or more conventional commercially actuators, or equivalents thereof.

[0076] An end of a safety sub assembly 20 is coupled to another end of the tension actuator assembly 18. In an exemplary embodiment, the safety sub assembly 20 may be, or may include elements, of one or more conventional apparatus that provide quick connection and/or disconnection of tubular members, or equivalents thereof.

[0077] An end of a sealing cup assembly 22 is coupled to another end of the safety sub assembly 20. In an exemplary embodiment, the sealing cup assembly 22 may be, or may include elements, of one or more conventional sealing cup assemblies, or other types of

sealing assemblies, that sealingly engage the interior surfaces of surrounding tubular members, or equivalents thereof.

[0078] An end of a casing lock assembly 24 is coupled to another end of the sealing cup assembly 22. In an exemplary embodiment, the casing lock assembly 24 may be, or may include elements, of one or more conventional casing lock assemblies that lock the position of wellbore casing, or equivalents thereof.

[0079] An end of an extension actuator assembly 26 is coupled to another end of the casing lock assembly 24. In an exemplary embodiment, the extension actuator assembly 26 may be, or may include elements, of one or more conventional actuators, or equivalents thereof.

[0080] An end of an adjustable bell section expansion cone assembly 28 is coupled to another end of the extension actuator assembly 26. In an exemplary embodiment, the adjustable bell section expansion cone assembly 28 may be, or may include elements, of one or more conventional adjustable expansion devices for radially expanding and plastically deforming wellbore casing, or equivalents thereof.

[0081] An end of an adjustable casing expansion cone assembly 30 is coupled to another end of the adjustable bell section expansion cone assembly 28. In an exemplary embodiment, the adjustable casing expansion cone assembly 30 may be, or may include elements, of one or more conventional adjustable expansion devices for radially expanding and plastically deforming wellbore casing, or equivalents thereof.

[0082] An end of a packer setting tool assembly 32 is coupled to another end of the adjustable casing expansion cone assembly 30. In an exemplary embodiment, the packer setting tool assembly 32 may be, or may include elements, of one or more conventional adjustable expansion devices for controlling the operation of a conventional packer, or equivalents thereof.

[0083] An end of a stinger assembly 34 is coupled to another end of the packer setting tool assembly 32. In an exemplary embodiment, the stinger assembly 34 may be, or may include elements, of one or more conventional devices for engaging a conventional packer, or equivalents thereof.

[0084] An end of a packer assembly 36 is coupled to another end of the stinger assembly 34. In an exemplary embodiment, the packer assembly 36 may be, or may include elements, of one or more conventional packers.

[0085] As illustrated in Fig. 1, in an exemplary embodiment, during operation of the system 10, an expandable wellbore casing 100 is coupled to and supported by the casing lock assembly 24 of the system. The system 10 is then positioned within a wellbore 102 that traverses a subterranean formation 104 and includes a preexisting wellbore casing 106.

[0086] As illustrated in Fig. 2, in an exemplary embodiment, the extension actuator

assembly 26 is then operated to move the adjustable bell section expansion cone assembly 28, adjustable casing expansion cone assembly 30, packer setting tool assembly 32, stinger assembly 34, packer assembly 36 downwardly in a direction 108 and out of an end of the expandable wellbore casing 100. After the adjustable bell section expansion cone assembly 28 and adjustable casing expansion cone assembly 30 have been moved to a position out of the end of the expandable wellbore casing 100, the adjustable bell section expansion cone assembly and adjustable casing expansion cone assembly are then operated to increase the outside diameters of the expansion cone assemblies. In an exemplary embodiment, the increased outside diameter of the adjustable bell section expansion cone assembly 28 is greater than the increased outside diameter of the adjustable casing expansion cone assembly 30.

[0087] As illustrated in Fig. 3, in an exemplary embodiment, the ball gripper assembly 16 is then operated to engage and hold the position of the expandable tubular member 100 stationary relative to the tubular support member 12. The tension actuator assembly 18 is then operated to move the adjustable bell section expansion cone assembly 28, adjustable casing expansion cone assembly 30, packer setting tool assembly 32, stinger assembly 34, packer assembly 36 upwardly in a direction 110 into and through the end of the expandable wellbore casing 100. As a result, the end of the expandable wellbore casing 100 is radially expanded and plastically deformed by the adjustable bell section expansion cone assembly 28 to form a bell section 112. In an exemplary embodiment, during the operation of the system 10 described above with reference to Fig. 3, the casing lock assembly 24 may or may not be coupled to the expandable wellbore casing 100.

[0088] In an exemplary embodiment, the length of the end of the expandable wellbore casing 100 that is radially expanded and plastically deformed by the adjustable bell section expansion cone assembly 28 is limited by the stroke length of the tension actuator assembly 18. In an exemplary embodiment, once the tension actuator assembly 18 completes a stroke, the ball gripper assembly 16 is operated to release the expandable tubular member 100, and the tubular support 12 is moved upwardly to permit the tension actuator assembly to be re-set. In this manner, the length of the bell section 112 can be further extended by continuing to stroke and then re-set the position of the tension actuator assembly 18. Note, that, during the upward movement of the tubular support 12 to re-set the position of the tension actuator assembly 18, the expandable tubular wellbore casing 100 is supported by the expansion surfaces of the adjustable bell section expansion cone assembly 28.

[0089] As illustrated in Fig. 4, in an exemplary embodiment, the casing lock assembly 24 is then operated to engage and maintain the position of the expandable wellbore casing 100 stationary relative to the tubular support 12. The adjustable bell section expansion cone assembly 28, adjustable casing expansion cone assembly 30, packer setting tool assembly

32, stinger assembly 34, and packer assembly 36 are displaced downwardly into the bell section 112 in a direction 114 relative to the expandable wellbore casing 100 by operating the extension actuator 26 and/or by displacing the system 10 downwardly in the direction 114 relative to the expandable wellbore casing. After the adjustable bell section expansion cone assembly 28 and adjustable casing expansion cone assembly 30 have been moved downwardly in the direction 114 into the bell section 112 of the expandable wellbore casing 100, the adjustable bell section expansion cone assembly is then operated to decrease the outside diameter of the adjustable bell section expansion cone assembly. In an exemplary embodiment, the decreased outside diameter of the adjustable bell section expansion cone assembly 28 is less than the increased outside diameter of the adjustable casing expansion cone assembly 30. In an exemplary embodiment, during the operation of the system illustrated and described above with reference to Fig. 4, the ball gripper 16 may or may not be operated to engage the expandable wellbore casing 100.

[0090] As illustrated in Fig. 5, in an exemplary embodiment, the casing lock assembly 24 is then disengaged from the expandable wellbore casing 100 and fluidic material 116 is then injected into the system 10 through the tubular support 12 to thereby pressurize an annulus 118 defined within the expandable wellbore casing below the cup sub assembly 22. As a result, a pressure differential is created across the cup seal assembly 22 that causes the cup seal assembly to apply a tensile force in the direction 120 to the system 10. As a result, the system 10 is displaced upwardly in the direction 120 relative to the expandable wellbore casing 100 thereby pulling the adjustable casing expansion cone assembly 30 upwardly in the direction 120 through the expandable wellbore casing thereby radially expanding and plastically deforming the expandable wellbore casing.

[0091] In an exemplary embodiment, the tension actuator assembly 16 may also be operated during the injection of the fluidic material 116 to displace the adjustable casing expansion cone assembly 30 upwardly relative to the tubular support 12. As a result, additional expansion forces may be applied to the expandable wellbore casing 100.

[0092] As illustrated in Fig. 6, in an exemplary embodiment, the radial expansion and plastic deformation of the expandable wellbore casing using the adjustable casing expansion cone assembly 30 continues until the packer assembly 36 is positioned within a portion of the expandable tubular member above the bell section 112. The packer assembly 36 may then be operated to engage the interior surface of the expandable wellbore casing 100 above the bell section 112.

[0093] In an exemplary embodiment, after the packer assembly 36 is operated to engage the interior surface of the expandable wellbore casing 100 above the bell section 112, a hardenable fluidic sealing material 122 may then be injected into the system 10 through the tubular support 12 and then out of the system through the packer assembly to

thereby permit the annulus between the expandable wellbore casing and the wellbore 102 to be filled with the hardenable fluidic sealing material. The hardenable fluidic sealing material 122 may then be allowed to cure to form a fluid tight annulus between the expandable wellbore casing 100 and the wellbore 102, before, during, or after the completion of the radial expansion and plastic deformation of the expandable wellbore casing.

[0094] As illustrated in Fig. 7, in an exemplary embodiment, the fluidic material 116 is then re-injected into the system 10 through the tubular support 12 to thereby re-pressurize the annulus 118 defined within the expandable wellbore casing below the cup sub assembly 22. As a result, a pressure differential is once again created across the cup seal assembly 22 that causes the cup seal assembly to once again apply a tensile force in the direction 120 to the system 10. As a result, the system 10 is displaced upwardly in the direction 120 relative to the expandable wellbore casing 100 thereby pulling the adjustable casing expansion cone assembly 30 upwardly in the direction 120 through the expandable wellbore casing thereby radially expanding and plastically deforming the expandable wellbore casing and disengaging the stinger assembly 34 from the packer assembly 36. In an exemplary embodiment, during this operational mode, the packer assembly 36 prevents the flow of fluidic materials out of the expandable wellbore casing 100. As a result, the pressurization of the annulus 118 is rapid and efficient thereby enhancing the operational efficiency of the subsequent radial expansion and plastic deformation of the expandable wellbore casing 100.

[0095] In an exemplary embodiment, the tension actuator assembly 16 may also be operated during the re-injection of the fluidic material 116 to displace the adjustable casing expansion cone assembly 30 upwardly relative to the tubular support 12. As a result, additional expansion forces may be applied to the expandable wellbore casing 100.

[0096] As illustrated in Fig. 8, in an exemplary embodiment, the radial expansion and plastic deformation of the expandable wellbore casing using the adjustable casing expansion cone assembly 30 continues until the adjustable casing expansion cone assembly 30 reaches the portion 124 of the expandable wellbore casing 100 that overlaps with the preexisting wellbore casing 106. At which point, the system 10 may radially expand the portion 124 of the expandable wellbore casing 100 that overlaps with the preexisting wellbore casing 106 and the surrounding portion of the preexisting wellbore casing. Consequently, in an exemplary embodiment, during the radial expansion of the portion 124 of the expandable wellbore casing 100 that overlaps with the preexisting wellbore casing 106, the tension actuator assembly 16 is also operated to displace the adjustable casing expansion cone assembly 30 upwardly relative to the tubular support 12. As a result, additional expansion forces may be applied to the expandable wellbore casing 100 and the preexisting wellbore casing 106 during the radial expansion of the portion 124 of the expandable wellbore casing that overlaps with the preexisting wellbore casing.

[0097] As illustrated in Fig. 9, in an exemplary embodiment, the entire length of the portion 124 of the expandable wellbore casing 100 that overlaps with the preexisting wellbore casing 106 is not radially expanded and plastically deformed. Rather, only part of the portion 124 of the expandable wellbore casing 100 that overlaps with the preexisting wellbore casing 106 is radially expanded and plastically deformed. The remaining part of the portion 124 of the expandable wellbore casing 100 that overlaps with the preexisting wellbore casing 106 is then cut away by operating the casing cutter assembly 14.

[0098] As illustrated in Fig. 10, the remaining part of the portion 124 of the expandable wellbore casing 100 that overlaps with the preexisting wellbore casing 106 that is cut away by operating the casing cutter assembly 14 is then also carried out of the wellbore 102 using the casing cutter assembly.

[0099] Furthermore, in an exemplary embodiment, the inside diameter of the expandable wellbore casing 100 above the bell section 112 is equal to the inside diameter of the portion of the preexisting wellbore casing 106 that does not overlap with the expandable wellbore casing 100. As a result, a wellbore casing is constructed that includes overlapping wellbore casings that together define an internal passage having a constant cross-sectional area.

[00100] In several exemplary embodiments, the system 10 includes one or more of the methods and apparatus disclosed in one or more of the following: (1) U.S. Patent Number 6,497,289, which was filed as U.S. Patent Application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, which claims priority from provisional application 60/111,293, filed on 12/7/98, (2) U.S. patent application serial no. 09/510,913, attorney docket no. 25791.7.02, filed on 2/23/2000, which claims priority from provisional application 60/121,702, filed on 2/25/99, (3) U.S. patent application serial no. 09/502,350, attorney docket no. 25791.8.02, filed on 2/10/2000, which claims priority from provisional application 60/119,611, filed on 2/11/99, (4) U.S. patent no. 6,328,113, which was filed as U.S. Patent Application serial number 09/440,338, attorney docket number 25791.9.02, filed on 11/15/99, which claims priority from provisional application 60/108,558, filed on 11/16/98, (5) U.S. patent application serial no. 10/169,434, attorney docket no. 25791.10.04, filed on 7/1/02, which claims priority from provisional application 60/183,546, filed on 2/18/00, (6) U.S. patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/11/99, (7) U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (8) U.S. patent number 6,575,240, which was filed as patent application serial no. 09/511,941, attorney docket no. 25791.16.02, filed on 2/24/2000, which claims priority from provisional application 60/121,907, filed on 2/26/99, (9) U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946,

attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (10) U.S. patent application serial no. 09/981,916, attorney docket no. 25791.18, filed on 10/18/01 as a continuation-in-part application of U.S. patent no. 6,328,113, which was filed as U.S. Patent Application serial number 09/440,338, attorney docket number 25791.9.02, filed on 11/15/99, which claims priority from provisional application 60/108,558, filed on 11/16/98, (11) U.S. patent number 6,604,763, which was filed as application serial no. 09/559,122, attorney docket no. 25791.23.02, filed on 4/26/2000, which claims priority from provisional application 60/131,106, filed on 4/26/99, (12) U.S. patent application serial no. 10/030,593, attorney docket no. 25791.25.08, filed on 1/8/02, which claims priority from provisional application 60/146,203, filed on 7/29/99, (13) U.S. provisional patent application serial no. 60/143,039, attorney docket no. 25791.26, filed on 7/9/99, (14) U.S. patent application serial no. 10/111,982, attorney docket no. 25791.27.08, filed on 4/30/02, which claims priority from provisional patent application serial no. 60/162,671, attorney docket no. 25791.27, filed on 11/1/1999, (15) U.S. provisional patent application serial no. 60/154,047, attorney docket no. 25791.29, filed on 9/16/1999, (16) U.S. provisional patent application serial no. 60/438,828, attorney docket no. 25791.31, filed on 1/9/03, (17) U.S. patent number 6,564,875, which was filed as application serial no. 09/679,907, attorney docket no. 25791.34.02, on 10/5/00, which claims priority from provisional patent application serial no. 60/159,082, attorney docket no. 25791.34, filed on 10/12/1999, (18) U.S. patent application serial no. 10/089,419, filed on 3/27/02, attorney docket no. 25791.36.03, which claims priority from provisional patent application serial no. 60/159,039, attorney docket no. 25791.36, filed on 10/12/1999, (19) U.S. patent application serial no. 09/679,906, filed on 10/5/00, attorney docket no. 25791.37.02, which claims priority from provisional patent application serial no. 60/159,033, attorney docket no. 25791.37, filed on 10/12/1999, (20) U.S. patent application serial no. 10/303,992, filed on 11/22/02, attorney docket no. 25791.38.07, which claims priority from provisional patent application serial no. 60/212,359, attorney docket no. 25791.38, filed on 6/19/2000, (21) U.S. provisional patent application serial no. 60/165,228, attorney docket no. 25791.39, filed on 11/12/1999, (22) U.S. provisional patent application serial no. 60/455,051, attorney docket no. 25791.40, filed on 3/14/03, (23) PCT application US02/2477, filed on 6/26/02, attorney docket no. 25791.44.02, which claims priority from U.S. provisional patent application serial no. 60/303,711, attorney docket no. 25791.44, filed on 7/6/01, (24) U.S. patent application serial no. 10/311,412, filed on 12/12/02, attorney docket no. 25791.45.07, which claims priority from provisional patent application serial no. 60/221,443, attorney docket no. 25791.45, filed on 7/28/2000, (25) U.S. patent application serial no. 10/, filed on 12/18/02, attorney docket no. 25791.46.07, which claims priority from provisional patent application serial no. 60/221,645, attorney docket no. 25791.46, filed on 7/28/2000, (26) U.S. patent

application serial no. 10/322,947, filed on 1/22/03, attorney docket no. 25791.47.03, which claims priority from provisional patent application serial no. 60/233,638, attorney docket no. 25791.47, filed on 9/18/2000, (27) U.S. patent application serial no. 10/406,648, filed on 3/31/03, attorney docket no. 25791.48.06, which claims priority from provisional patent application serial no. 60/237,334, attorney docket no. 25791.48, filed on 10/2/2000, (28) PCT application US02/04353, filed on 2/14/02, attorney docket no. 25791.50.02, which claims priority from U.S. provisional patent application serial no. 60/270,007, attorney docket no. 25791.50, filed on 2/20/2001, (29) U.S. patent application serial no. 10/465,835, filed on 6/13/03, attorney docket no. 25791.51.06, which claims priority from provisional patent application serial no. 60/262,434, attorney docket no. 25791.51, filed on 1/17/2001, (30) U.S. patent application serial no. 10/465,831, filed on 6/13/03, attorney docket no. 25791.52.06, which claims priority from U.S. provisional patent application serial no. 60/259,486, attorney docket no. 25791.52, filed on 1/3/2001, (31) U.S. provisional patent application serial no. 60/452,303, filed on 3/5/03, attorney docket no. 25791.53, (32) U.S. patent number 6,470,966, which was filed as patent application serial number 09/850,093, filed on 5/7/01, attorney docket no. 25791.55, as a divisional application of U.S. Patent Number 6,497,289, which was filed as U.S. Patent Application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, which claims priority from provisional application 60/111,293, filed on 12/7/98, (33) U.S. patent number 6,561,227, which was filed as patent application serial number 09/852,026 , filed on 5/9/01, attorney docket no. 25791.56, as a divisional application of U.S. Patent Number 6,497,289, which was filed as U.S. Patent Application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, which claims priority from provisional application 60/111,293, filed on 12/7/98, (34) U.S. patent application serial number 09/852,027, filed on 5/9/01, attorney docket no. 25791.57, as a divisional application of U.S. Patent Number 6,497,289, which was filed as U.S. Patent Application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, which claims priority from provisional application 60/111,293, filed on 12/7/98, (35) PCT Application US02/25608, attorney docket no. 25791.58.02, filed on 8/13/02, which claims priority from provisional application 60/318,021, filed on 9/7/01, attorney docket no. 25791.58, (36) PCT Application US02/24399, attorney docket no. 25791.59.02, filed on 8/1/02, which claims priority from U.S. provisional patent application serial no. 60/313,453, attorney docket no. 25791.59, filed on 8/20/2001, (37) PCT Application US02/29856, attorney docket no. 25791.60.02, filed on 9/19/02, which claims priority from U.S. provisional patent application serial no. 60/326,886, attorney docket no. 25791.60, filed on 10/3/2001, (38) PCT Application US02/20256, attorney docket no. 25791.61.02, filed on 6/26/02, which claims priority from U.S. provisional patent application serial no. 60/303,740, attorney docket no. 25791.61, filed on 7/6/2001, (39) U.S. patent application serial no. 09/962,469, filed on

9/25/01, attorney docket no. 25791.62, which is a divisional of U.S. patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/11/99, (40) U.S. patent application serial no. 09/962,470, filed on 9/25/01, attorney docket no. 25791.63, which is a divisional of U.S. patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/11/99, (41) U.S. patent application serial no. 09/962,471, filed on 9/25/01, attorney docket no. 25791.64, which is a divisional of U.S. patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/11/99, (42) U.S. patent application serial no. 09/962,467, filed on 9/25/01, attorney docket no. 25791.65, which is a divisional of U.S. patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/11/99, (43) U.S. patent application serial no. 09/962,468, filed on 9/25/01, attorney docket no. 25791.66, which is a divisional of U.S. patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/11/99, (44) PCT application US 02/25727, filed on 8/14/02, attorney docket no. 25791.67.03, which claims priority from U.S. provisional patent application serial no. 60/317,985, attorney docket no. 25791.67, filed on 9/6/2001, and U.S. provisional patent application serial no. 60/318,386, attorney docket no. 25791.67.02, filed on 9/10/2001, (45) PCT application US 02/39425, filed on 12/10/02, attorney docket no. 25791.68.02, which claims priority from U.S. provisional patent application serial no. 60/343,674 , attorney docket no. 25791.68, filed on 12/27/2001, (46) U.S. utility patent application serial no. 09/969,922, attorney docket no. 25791.69, filed on 10/3/2001, which is a continuation-in-part application of U.S. patent no. 6,328,113, which was filed as U.S. Patent Application serial number 09/440,338, attorney docket number 25791.9.02, filed on 11/15/99, which claims priority from provisional application 60/108,558, filed on 11/16/98, (47) U.S. utility patent application serial no. 10/516,467, attorney docket no. 25791.70, filed on 12/10/01, which is a continuation application of U.S. utility patent application serial no. 09/969,922, attorney docket no. 25791.69, filed on 10/3/2001, which is a continuation-in-part application of U.S. patent no. 6,328,113, which was filed as U.S. Patent Application serial number 09/440,338, attorney docket number 25791.9.02, filed on 11/15/99, which claims priority from provisional application 60/108,558, filed on 11/16/98, (48) PCT application US 03/00609, filed on 1/9/03, attorney docket no. 25791.71.02, which claims priority from U.S. provisional patent application serial no. 60/357,372 , attorney docket no. 25791.71, filed on 2/15/02, (49) U.S. patent application serial no. 10/074,703, attorney docket no. 25791.74, filed on 2/12/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application

serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (50) U.S. patent application serial no. 10/074,244, attorney docket no. 25791.75, filed on 2/12/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (51) U.S. patent application serial no. 10/076,660, attorney docket no. 25791.76, filed on 2/15/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (52) U.S. patent application serial no. 10/076,661, attorney docket no. 25791.77, filed on 2/15/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (53) U.S. patent application serial no. 10/076,659, attorney docket no. 25791.78, filed on 2/15/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (54) U.S. patent application serial no. 10/078,928, attorney docket no. 25791.79, filed on 2/20/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (55) U.S. patent application serial no. 10/078,922, attorney docket no. 25791.80, filed on 2/20/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (56) U.S. patent application serial no. 10/078,921, attorney docket no. 25791.81, filed on 2/20/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (57) U.S. patent application serial no. 10/261,928, attorney docket no. 25791.82, filed on 10/1/02, which is a divisional of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (58) U.S. patent application serial no. 10/079,276 , attorney docket no. 25791.83, filed on 2/20/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99,

(59) U.S. patent application serial no. 10/262,009, attorney docket no. 25791.84, filed on 10/1/02, which is a divisional of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (60) U.S. patent application serial no. 10/092,481, attorney docket no. 25791.85, filed on 3/7/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (61) U.S. patent application serial no. 10/261,926, attorney docket no. 25791.86, filed on 10/1/02, which is a divisional of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (62) PCT application US 02/36157, filed on 11/12/02, attorney docket no. 25791.87.02, which claims priority from U.S. provisional patent application serial no. 60/338,996, attorney docket no. 25791.87, filed on 11/12/01, (63) PCT application US 02/36267, filed on 11/12/02, attorney docket no. 25791.88.02, which claims priority from U.S. provisional patent application serial no. 60/339,013, attorney docket no. 25791.88, filed on 11/12/01, (64) PCT application US 03/11765, filed on 4/16/03, attorney docket no. 25791.89.02, which claims priority from U.S. provisional patent application serial no. 60/383,917, attorney docket no. 25791.89, filed on 5/29/02, (65) PCT application US 03/15020, filed on 5/12/03, attorney docket no. 25791.90.02, which claims priority from U.S. provisional patent application serial no. 60/391,703, attorney docket no. 25791.90, filed on 6/26/02, (66) PCT application US 02/39418, filed on 12/10/02, attorney docket no. 25791.92.02, which claims priority from U.S. provisional patent application serial no. 60/346,309, attorney docket no. 25791.92, filed on 1/7/02, (67) PCT application US 03/06544, filed on 3/4/03, attorney docket no. 25791.93.02, which claims priority from U.S. provisional patent application serial no. 60/372,048, attorney docket no. 25791.93, filed on 4/12/02, (68) U.S. patent application serial no. 10/331,718, attorney docket no. 25791.94, filed on 12/30/02, which is a divisional U.S. patent application serial no. 09/679,906, filed on 10/5/00, attorney docket no. 25791.37.02, which claims priority from provisional patent application serial no. 60/159,033, attorney docket no. 25791.37, filed on 10/12/1999, (69) PCT application US 03/04837, filed on 2/29/03, attorney docket no. 25791.95.02, which claims priority from U.S. provisional patent application serial no. 60/363,829, attorney docket no. 25791.95, filed on 3/13/02, (70) U.S. patent application serial no. 10/261,927, attorney docket no. 25791.97, filed on 10/1/02, which is a divisional of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (71) U.S. patent application serial no. 10/262,008, attorney docket no.

25791.98, filed on 10/1/02, which is a divisional of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (72) U.S. patent application serial no. 10/261,925, attorney docket no. 25791.99, filed on 10/1/02, which is a divisional of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (73) U.S. patent application serial no. 10/199,524, attorney docket no. 25791.100, filed on 7/19/02, which is a continuation of U.S. Patent Number 6,497,289, which was filed as U.S. Patent Application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, which claims priority from provisional application 60/111,293, filed on 12/7/98, (74) PCT application US 03/10144, filed on 3/28/03, attorney docket no. 25791.101.02, which claims priority from U.S. provisional patent application serial no. 60/372,632, attorney docket no. 25791.101, filed on 4/15/02, (75) U.S. provisional patent application serial no. 60/412,542, attorney docket no. 25791.102, filed on 9/20/02, (76) PCT application US 03/14153, filed on 5/6/03, attorney docket no. 25791.104.02, which claims priority from U.S. provisional patent application serial no. 60/380,147, attorney docket no. 25791.104, filed on 5/6/02, (77) PCT application US 03/19993, filed on 6/24/03, attorney docket no. 25791.106.02, which claims priority from U.S. provisional patent application serial no. 60/397,284, attorney docket no. 25791.106, filed on 7/19/02, (78) PCT application US 03/13787, filed on 5/5/03, attorney docket no. 25791.107.02, which claims priority from U.S. provisional patent application serial no. 60/387,486 , attorney docket no. 25791.107, filed on 6/10/02, (79) PCT application US 03/18530, filed on 6/11/03, attorney docket no. 25791.108.02, which claims priority from U.S. provisional patent application serial no. 60/387,961, attorney docket no. 25791.108, filed on 6/12/02, (80) PCT application US 03/20694, filed on 7/1/03, attorney docket no. 25791.110.02, which claims priority from U.S. provisional patent application serial no. 60/398,061, attorney docket no. 25791.110, filed on 7/24/02, (81) PCT application US 03/20870, filed on 7/2/03, attorney docket no. 25791.111.02, which claims priority from U.S. provisional patent application serial no. 60/399,240, attorney docket no. 25791.111, filed on 7/29/02, (82) U.S. provisional patent application serial no. 60/412,487, attorney docket no. 25791.112, filed on 9/20/02, (83) U.S. provisional patent application serial no. 60/412,488, attorney docket no. 25791.114, filed on 9/20/02, (84) U.S. patent application serial no. 10/280,356, attorney docket no. 25791.115, filed on 10/25/02, which is a continuation of U.S. patent number 6,470,966, which was filed as patent application serial number 09/850,093, filed on 5/7/01, attorney docket no. 25791.55, as a divisional application of U.S. Patent Number 6,497,289, which was filed as U.S. Patent Application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, which claims priority from provisional

application 60/111,293, filed on 12/7/98, (85) U.S. provisional patent application serial no. 60/412,177, attorney docket no. 25791.117, filed on 9/20/02, (86) U.S. provisional patent application serial no. 60/412,653, attorney docket no. 25791.118, filed on 9/20/02, (87) U.S. provisional patent application serial no. 60/405,610, attorney docket no. 25791.119, filed on 8/23/02, (88) U.S. provisional patent application serial no. 60/405,394, attorney docket no. 25791.120, filed on 8/23/02, (89) U.S. provisional patent application serial no. 60/412,544, attorney docket no. 25791.121, filed on 9/20/02, (90) PCT application US 03/24779, filed on 8/8/03, attorney docket no. 25791.125.02, which claims priority from U.S. provisional patent application serial no. 60/407,442, attorney docket no. 25791.125, filed on 8/30/02, (91) U.S. provisional patent application serial no. 60/423,363, attorney docket no. 25791.126, filed on 12/10/02, (92) U.S. provisional patent application serial no. 60/412,196, attorney docket no. 25791.127, filed on 9/20/02, (93) U.S. provisional patent application serial no. 60/412,187, attorney docket no. 25791.128, filed on 9/20/02, (94) U.S. provisional patent application serial no. 60/412,371, attorney docket no. 25791.129, filed on 9/20/02, (95) U.S. patent application serial no. 10/382,325, attorney docket no. 25791.145, filed on 3/5/03, which is a continuation of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (96) U.S. patent application serial no. 10/624,842, attorney docket no. 25791.151, filed on 7/22/03, which is a divisional of U.S. patent application serial no. 09/502,350, attorney docket no. 25791.8.02, filed on 2/10/2000, which claims priority from provisional application 60/119,611, filed on 2/11/99, (97) U.S. provisional patent application serial no. 60/431,184, attorney docket no. 25791.157, filed on 12/5/02, (98) U.S. provisional patent application serial no. 60/448,526, attorney docket no. 25791.185, filed on 2/18/03, (99) U.S. provisional patent application serial no. 60/461,539, attorney docket no. 25791.186, filed on 4/9/03, (100) U.S. provisional patent application serial no. 60/462,750, attorney docket no. 25791.193, filed on 4/14/03, (101) U.S. provisional patent application serial no. 60/436,106, attorney docket no. 25791.200, filed on 12/23/02, (102) U.S. provisional patent application serial no. 60/442,942, attorney docket no. 25791.213, filed on 1/27/03, (103) U.S. provisional patent application serial no. 60/442,938, attorney docket no. 25791.225, filed on 1/27/03, (104) U.S. provisional patent application serial no. 60/418,687, attorney docket no. 25791.228, filed on 4/18/03, (105) U.S. provisional patent application serial no. 60/454,896, attorney docket no. 25791.236, filed on 3/14/03, (106) U.S. provisional patent application serial no. 60/450,504, attorney docket no. 25791.238, filed on 2/26/03, (107) U.S. provisional patent application serial no. 60/451,152, attorney docket no. 25791.239, filed on 3/9/03, (108) U.S. provisional patent application serial no. 60/455,124, attorney docket no. 25791.241, filed on 3/17/03, (109) U.S. provisional patent application serial no. 60/453,678, attorney docket no.

25791.253, filed on 3/11/03, (110) U.S. patent application serial no. 10/421,682, attorney docket no. 25791.256, filed on 4/23/03, which is a continuation of U.S. patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/11/99, (111) U.S. provisional patent application serial no. 60/457,965, attorney docket no. 25791.260, filed on 3/27/03, (112) U.S. provisional patent application serial no. 60/455,718, attorney docket no. 25791.262, filed on 3/18/03, (113) U.S. patent number 6,550,821, which was filed as patent application serial no. 09/811,734, filed on 3/19/01, (114) U.S. patent application serial no. 10/436,467, attorney docket no. 25791.268, filed on 5/12/03, which is a continuation of U.S. patent number 6,604,763, which was filed as application serial no. 09/559,122, attorney docket no. 25791.23.02, filed on 4/26/2000, which claims priority from provisional application 60/131,106, filed on 4/26/99, (115) U.S. provisional patent application serial no. 60/459,776, attorney docket no. 25791.270, filed on 4/2/03, (116) U.S. provisional patent application serial no. 60/461,094, attorney docket no. 25791.272, filed on 4/8/03, (117) U.S. provisional patent application serial no. 60/461,038, attorney docket no. 25791.273, filed on 4/7/03, (118) U.S. provisional patent application serial no. 60/463,586, attorney docket no. 25791.277, filed on 4/17/03, (119) U.S. provisional patent application serial no. 60/472,240, attorney docket no. 25791.286, filed on 5/20/03, (120) U.S. patent application serial no. 10/619,285, attorney docket no. 25791.292, filed on 7/14/03, which is a continuation-in-part of U.S. utility patent application serial no. 09/969,922, attorney docket no. 25791.69, filed on 10/3/2001, which is a continuation-in-part application of U.S. patent no. 6,328,113, which was filed as U.S. Patent Application serial number 09/440,338, attorney docket number 25791.9.02, filed on 11/15/99, which claims priority from provisional application 60/108,558, filed on 11/16/98, (121) U.S. utility patent application serial no. 10/418,688, attorney docket no. 25791.257, which was filed on 4/18/03, as a division of U.S. utility patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/11/99, (122) PCT patent application serial no. PCT/US04/06246, attorney docket no. 25791.238.02, filed on 2/26/2004, (123) PCT patent application serial number PCT/US04/_____, attorney docket number 25791.40.02, filed on 3/15/04, (124) PCT patent application serial number PCT/US04/_____, attorney docket number 25791.236.02, filed on 3/15/04, (125) PCT patent application serial number PCT/US04/_____, attorney docket number 25791.262.02, filed on 3/18/04, (126) PCT patent application serial number PCT/US04/_____, attorney docket number 25791.253.02, filed on 3/11/2004, and (127) PCT patent application serial number PCT/US04/_____, attorney docket number 25791.260, filed on 3/26/2004, the disclosures of which are incorporated herein by reference.

[00101] In an exemplary embodiment, the casing cutter assembly 14 is provided and operates substantially, at least in part, as disclosed in one or more of the following: (1) PCT patent application serial number PCT/US03/29858, attorney docket number 25791.112.02, filed on 9/22/2003, and/or (2) PCT patent application serial number PCT/US04/_____, attorney docket number 25791.253.02, filed on 3/11/2004, and/or (3) PCT patent application serial number PCT/US04/_____, attorney docket number 25791.260, filed on 3/26/2004, the disclosures of which are incorporated herein by reference.

[00102] In an exemplary embodiment, as illustrated in Figs. 11-1 and 11-2, 11A1 to 11A2, 11B1 to 11B2, 11C, 11D, 11E, 11F, 11G, 11H, 11I, 11j, 11K, 11L, 11M, 11N, 11O, 11P, 11Q, 11R, 11S, 11T, 11U, 11V, 11W, 11X, 11Y, 11Z1 to 11Z4, 11AA1 to 11AA4, 11AB1 to 11AB4, 11AC1 to 11AC4, 11AD, and 11AE, the casing cutter assembly 14 includes an upper tubular tool joint 14002 that defines a longitudinal passage 14002a and mounting holes, 14002b and 14002c, and includes an internal threaded connection 14002d, an inner annular recess 14002e, an inner annular recess 14002f, and an internal threaded connection 14002g. A tubular torque plate 14004 that defines a longitudinal passage 14004a and includes circumferentially spaced apart teeth 14004b is received within, mates with, and is coupled to the internal annular recess 14002e of the upper tubular tool joint 14002.

[00103] Circumferentially spaced apart teeth 14006a of an end of a tubular lower mandrel 14006 that defines a longitudinal passage 14006b, a radial passage 14006ba, and a radial passage 14006bb and includes an external threaded connection 14006c, an external flange 14006d, an external annular recess 14006e having a step 14006f at one end, an external annular recess 14006g, external teeth 14006h, an external threaded connection 14006i, and an external annular recess 14006j engage the circumferentially spaced apart teeth 14004b of the tubular torque plate 14004. An internal threaded connection 14008a of an end of a tubular toggle bushing 14008 that defines a longitudinal passage 14008b, an upper longitudinal slot 14008c , a lower longitudinal slot 14008d, mounting holes, 14008e, 14008f, 14008g, 14008h, 14008i, 14008j, 14008k, 14008l, 14008m, 14008n, 14008o, 14008p, 14008q, 14008r, 14008s, 14008t, 14008u, 14008v, 14008w, 14008x, 14008xa, and 14008xb, and includes an external annular recess 14008y, internal annular recess 14008z, external annular recess 14008aa, and an external annular recess 14008ab receives and is coupled to the external threaded connection 14006c of the tubular lower mandrel 14006.

[00104] A sealing element 14010 is received within the external annular recess 14008y of the tubular toggle bushing 14008 for sealing the interface between the tubular toggle bushing and the upper tubular tool joint 14002. A sealing element 14012 is received within the internal annular recess 14008z of the tubular toggle bushing 14008 for sealing the interface between the tubular toggle bushing and the tubular lower mandrel 14006.

[00105] Mounting screws, 14014a and 14014b, mounted within and coupled to the

mounting holes, 14008w and 14008x, respectively, of the tubular toggle bushing 14008 are also received within the mounting holes, 14002b and 14002c, of the upper tubular tool joint 14002. Mounting pins, 14016a, 14016b, 14016c, 14016d, and 14016e, are mounted within the mounting holes, 14008e, 14008f, 14008g, 14008h, and 14008i, respectively. Mounting pins, 14018a, 14018b, 14018c, 14018d, and 14018e, are mounted within the mounting holes, 14008t, 14008s, 14008r, 14008q, and 14008p, respectively. Mounting screws, 14020a and 14020b, are mounted within the mounting holes, 14008u and 14008v, respectively.

[00106] A first upper toggle link 14022 defines mounting holes, 14022a and 14022b, for receiving the mounting pins, 14016a and 14016b, and includes a mounting pin 14022c at one end. A first lower toggle link 14024 defines mounting holes, 14024a, 14024b, and 14024c, for receiving the mounting pins, 14022c, 14016c, and 14016d, respectively and includes an engagement arm 14024d. A first trigger 14026 defines a mounting hole 14026a for receiving the mounting pin 14016e and includes an engagement arm 14026b at one end, an engagement member 14026c, and an engagement arm 14026d at another end.

[00107] A second upper toggle link 14028 defines mounting holes, 14028a and 14028b, for receiving the mounting pins, 14018a and 14018b, and includes a mounting pin 14028c at one end. A second lower toggle link 14030 defines mounting holes, 14030a, 14030b, and 14030c, for receiving the mounting pins, 14028c, 14018c, and 14018d, respectively and includes an engagement arm 14030d. A second trigger 14032 defines a mounting hole 14032a for receiving the mounting pin 14018e and includes an engagement arm 14032b at one end, an engagement member 14032c, and an engagement arm 14032d at another end.

[00108] An end of a tubular spring housing 14034 that defines a longitudinal passage 14034a, mounting holes, 14034b and 14034c, and mounting holes, 14034ba and 14034ca, and includes an internal flange 14034d and an internal annular recess 14034e at one end, and an internal flange 14034f, an internal annular recess 14034g, an internal annular recess 14034h, and an external threaded connection 14034i at another end receives and mates with the end of the tubular toggle bushing 14008. Mounting screws, 14035a and 14035b, are mounted within and coupled to the mounting holes, 14008xb and 14008xa, respectively, of the tubular toggle bushing 14008 and are received within the mounting holes, 14034ba and 14034ca, respectively, of the tubular spring housing 14034.

[00109] A tubular retracting spring ring 14036 that defines mounting holes, 14036a and 14036b, receives and mates with a portion of the tubular lower mandrel 14006 and is received within and mates with a portion of the tubular spring housing 14034. Mounting screws, 14038a and 14038b, are mounted within and coupled to the mounting holes, 14036a and 14036b, respectively, of the tubular retracting spring ring 14036 and extend into the mounting holes, 14034b and 14034c, respectively, of the tubular spring housing 14034.

[00110] Casing diameter sensor springs, 14040a and 14040b, are positioned within the longitudinal slots, 14008c and 1408d, respectively, of the tubular toggle bushing 14008 that engage the engagement members, 14026c and 14032c, and engagement arms,14026d and 14032d, of the first and second triggers, 14026 and 14032, respectively. An inner flange 14042a of an end of a tubular spring washer 14042 mates with and receives a portion of the tubular lower mandrel 14006 and an end face of the inner flange of the tubular spring washer is positioned proximate and end face of the external flange 14006d of the tubular lower mandrel. The tubular spring washer 14042 is further received within the longitudinal passage 14034a of the tubular spring housing 14034.

[00111] An end of a retracting spring 14044 that receives the tubular lower mandrel 14006 is positioned within the tubular spring washer 14042 in contact with the internal flange 14042a of the tubular spring washer and the other end of the retracting spring is positioned in contact with an end face of the tubular retracting spring ring 14036.

[00112] A sealing element 14046 is received within the external annular recess 14006j of the tubular lower mandrel 14006 for sealing the interface between the tubular lower mandrel and the tubular spring housing 14034. A sealing element 14048 is received within the internal annular recess 14034h of the tubular spring housing 14034 for sealing the interface between the tubular spring housing and the tubular lower mandrel 14006.

[00113] An internal threaded connection 14050a of an end of a tubular upper hinge sleeve 14050 that includes an internal flange 14050b and an internal pivot 14050c receives and is coupled to the external threaded connection 14034i of the end of the tubular spring housing 14034.

[00114] An external flange 14052a of a base member 14052b of an upper cam assembly 14052, that is mounted upon and receives the lower tubular mandrel 14006, that includes an internal flange 14052c that is received within the external annular recess 14006e of the lower tubular mandrel 14006 and a plurality of circumferentially spaced apart cam arms 14052d extending from the base member mates with and is received within the tubular upper hinge sleeve 14050. The base member 14052b of the upper cam assembly 14052 further includes a plurality of circumferentially spaced apart teeth 14052f that mate with and are received within a plurality of circumferentially spaced apart teeth 14034j provided on the end face of the tubular spring housing 14034 and an end face of the external flange 14052a of the base member of the upper cam assembly is positioned in opposing relation to an end face of the internal flange 14050b of the tubular upper hinge sleeve 14050. Each of the cam arms 14052d of the upper cam assembly 14052 include external cam surfaces 14052e. In an exemplary embodiment, the teeth 14052f of the base member 14052b of the upper cam assembly 14052 and the teeth 14034j provided on the end face of the tubular spring housing 14034 permit torsional loads to be transmitted between the tubular spring housing

and the upper cam assembly.

[00115] A plurality of circumferentially spaced apart upper casing cutter segments 14054 are mounted upon and receive the lower tubular mandrel 14006 and each include an external pivot recess 14054a for mating with and receiving the internal pivot 14050c of the tubular upper hinge sleeve 14050 and an external flange 14054b and are pivotally mounted within the tubular upper hinge sleeve and are interleaved with the circumferentially spaced apart cam arms 14052d of the upper cam assembly 14052. A casing cutter element 14056 is coupled to and supported by the upper surface of each upper casing cutter segments 14054 proximate the external flange 14054b.

[00116] A plurality of circumferentially spaced apart lower casing cutter segments 14058 are mounted upon and receive the lower tubular mandrel 14006, are interleaved among the upper casing cutter segments 14054, are oriented in the opposite direction to the upper casing cutter segments 14054, each include an external pivot recess 14058a, and are positioned in opposing relation to corresponding circumferentially spaced apart cam arms 14052d of the upper cam assembly 14052.

[00117] A lower cam assembly 14060 is mounted upon and receives the lower tubular mandrel 14006 that includes a base member 14060a having an external flange 14060b, a plurality of circumferentially spaced apart cam arms 14060d that extend from the base member that each include external cam surfaces 14060e and define mounting holes 14060f and 14060g. The base member 14060a of the lower cam assembly 14060 further includes a plurality of circumferentially spaced apart teeth 14060h. The circumferentially spaced apart cam arms 14060d of the lower cam assembly 14060 are interleaved among the lower casing cutter segments 14058 and the circumferentially spaced apart cam arms 14052d of the upper cam assembly 14052 and positioned in opposing relation to corresponding upper casing cutter segments 14054.

[00118] Mounting screws, 14062a, 14062b, 14062c, and 14062e, are mounted within the corresponding mounting holes, 14060f and 14060g, of the lower cam assembly 14060 and are received within the external annular recess 14006g of the lower cam assembly 14060.

[00119] A tubular lower hinge sleeve 14064 that receives the lower casing cutter segments 14058 and the lower cam assembly 14060 includes an internal flange 14064a for engaging the external flange 14060b of the base member of the lower cam assembly 14060, an internal pivot 14064b for engaging and receiving the external pivot recess 14058a of the lower casing cutter segments 14058 thereby pivotally mounting the lower casing cutter segments within the tubular lower hinge sleeve, and an internal threaded connection 14064c.

[00120] An external threaded connection 14066a of an end of a tubular sleeve 14066 that defines mounting holes, 14066b and 14066c, and includes an internal annular recess

14066d having a shoulder 14066e, an internal flange 14066f, and an internal threaded connection 14066g at another end is received within and coupled to the internal threaded connection 14064c of the tubular lower hinge sleeve 14064. An external threaded connection 14068a of an end of a tubular member 14068 that defines a longitudinal passage 14068b and mounting holes, 14068c and 14068d, and includes an external annular recess 14068e, and an external threaded connection 14068f at another end is received within and is coupled to the internal threaded connection 14066g of the tubular sleeve 14066.

[00121] Mounting screws, 14070a and 14070b, are mounted in and coupled to the mounting holes, 14068c and 14068d, respectively, of the tubular member 14068 that also extend into the mounting holes, 14066b and 14066c, respectively, of the tubular sleeve 14066. A sealing element 14072 is received within the external annular recess 14068e of the tubular member 14068 for sealing the interface between the tubular member and the tubular sleeve 14066.

[00122] An internal threaded connection 14074a of a tubular retracting piston 14074 that defines a longitudinal passage 14074b and includes an internal annular recess 14074c and an external annular recess 14074d receives and is coupled to the external threaded connection 14006i of the tubular lower mandrel 14006. A sealing element 14076 is received within the external annular recess 14074d of the tubular retracting piston 14074 for sealing the interface between the tubular retracting piston and the tubular sleeve 14066. A sealing element 14078 is received within the internal annular recess 14074c of the tubular retracting piston 14074 for sealing the interface between the tubular retracting piston and the tubular lower mandrel 14006.

[00123] Locking dogs 14080 mate with and receive the external teeth 14006h of the tubular lower mandrel 14006. A spacer ring 14082 is positioned between an end face of the locking dogs 14080 and an end face of the lower cam assembly 14060. A release piston 14084 mounted upon the tubular lower mandrel 14006 defines a radial passage 14084a for mounting a burst disk 14086 includes sealing elements, 14084b, 14084c, and 14084d. The sealing elements, 14084b and 14084d, sealing the interface between the release piston 14084 and the tubular lower mandrel 14006. An end face of the release piston 14084 is positioned in opposing relation to an end face of the locking dogs 14080.

[00124] A release sleeve 14088 that receives and is mounted upon the locking dogs 14080 and the release piston 14084 includes an internal flange 14088a at one end that sealingly engages the tubular lower mandrel 14006. A bypass sleeve 14090 that receives and is mounted upon the release sleeve 14088 includes an internal flange 14090a at one end.

[00125] In an exemplary embodiment, during operation of the casing cutter assembly 14, the retracting spring 14044 is compressed and thereby applies a biasing spring force in a

direction 14092 from the lower tubular mandrel 14006 to the tubular spring housing 14034 that, in the absence of other forces, moves and/or maintains the upper cam assembly 14052 and the upper casing cutter segments 14054 out of engagement with the lower casing cutter segments 14058 and the lower cam assembly 14060. In an exemplary embodiment, during operation of the casing cutter assembly 14, an external threaded connection 12a of an end of the tubular support member 12 is coupled to the internal threaded connection 14002d of the upper tubular tool joint 14002 and an internal threaded connection 16a of an end of the ball gripper assembly 16 is coupled to the external threaded connection 14068f of the tubular member 14068.

[00126] The upper cam assembly 14052 and the upper casing cutter segments 14054 may be brought into engagement with the lower casing cutter segments 14058 and the lower cam assembly 14060 by pressurizing an annulus 14094 defined between the lower tubular mandrel 14006 and the tubular spring housing 14034. In particular, injection of fluidic materials into the cam cutter assembly 14 through the longitudinal passage 14006b of the lower tubular mandrel 14006 and into the radial passage 14006ba may pressurize the annulus 14094 thereby creating sufficient operating pressure to generate a force in a direction 14096 sufficient to overcome the biasing force of the retracting spring 14044. As a result, the spring housing 14034 may be displaced in the direction 14096 relative to the lower tubular mandrel 14006 thereby displacing the tubular upper hinge sleeve 14050, upper cam assembly 14052 , and upper casing cutter segments 14054 in the direction 14096.

[00127] In an exemplary embodiment, as illustrated in Figs. 11P, 11Q and 11R, the displacement of the upper cam assembly 14052 and upper casing cutter segments 14054 in the direction 14096 will cause the lower casing cutter segments 14058 to ride up the cam surfaces of the cam arms of the upper cam assembly 14052 while also pivoting about the lower tubular hinge segment 14064, and will also cause the upper casing cutter segments 14054 to ride up the cam surfaces of the cam arms of the lower cam assembly 14060 while also pivoting about the upper tubular hinge segment 14050.

[00128] In an exemplary embodiment, during the operation of the casing cutter assembly 14, when the upper and lower casing cutter segments, 14054 and 14058, brought into axial alignment in a radially expanded position, the casing cutter elements of the casing cutter segments are brought into intimate contact with the interior surface of a pre-selected portion of the expandable wellbore casing 100. The casing cutter assembly 14 may then be rotated to thereby cause the casing cutter elements to cut through the expandable wellbore casing. The portion of the expandable wellbore casing 100 cut away from the remaining portion on the expandable wellbore casing may then be carried out of the wellbore 102 with the cut away portion of the expandable wellbore casing supported by the casing cutter elements.

[00129] In an exemplary embodiment, the upper cam assembly 14052 and the upper

casing cutter segments 14054 may be moved out of engagement with the lower casing cutter segments 14058 and the lower cam assembly 14060 by reducing the operating pressure within the annulus 14094.

[00130] In an alternative embodiment, as illustrated in Figs. 11S, 11T, 11U and 11V, during operation of the casing cutter assembly 14, the upper cam assembly 14052 and the upper casing cutter segments 14054 may also be moved out of engagement with the lower casing cutter segments 14058 and the lower cam assembly 14060 by sensing the operating pressure within the longitudinal passage 14006b of the lower tubular mandrel 14006. In particular, as illustrated in Fig. 11T, if the operating pressure within the longitudinal passage 14006b and radial passage 14006bb of the lower tubular mandrel 14006 exceeds a predetermined value, the burst disc 14086 will open the passage 14084a thereby pressurizing the interior of the tubular release sleeve 14088 thereby displacing the tubular release sleeve 14088 downwardly in a direction 14092 away from engagement with the locking dogs 14080.

[00131] As a result, as illustrated in Fig. 11U, the locking dogs 14080 are displaced outwardly in the radial directed and thereby released from engagement with the lower tubular mandrel 14006 thereby permitting the lower casing cutter segments 14058 and the lower cam assembly 14060 to be displaced downwardly relative to the lower tubular mandrel.

[00132] As a result, as illustrated in Fig. 11V, the operating pressure within the lower tubular mandrel 14066 may then cause the lower tubular mandrel to be displaced downwardly in the direction 14094 relative to the tubular lower mandrel 14006 and the retracting piston 14074. As a result, the lower tubular mandrel 14066, the lower casing cutter segments 14058, the lower cam assembly 14060, and tubular lower hinge sleeve 14064 are displaced downwardly in the direction 14094 relative to the tubular spring housing 14034 thereby moving the lower casing cutter segments 14058 and the lower cam assembly 14060 out of engagement with the upper cam assembly 14052 and the upper casing cutter segments 14054.

[00133] In an exemplary embodiment, as illustrated in Figs. 11W, 11X, and 11Y, during operation of the casing cutter assembly 14, the casing cutter assembly 14 senses the diameter of the expandable wellbore casing 100 using the upper toggle links, 14022 and 14028, lower toggle links, 14024 and 14030, and triggers, 14026 and 14032, and then prevents the engagement of the upper cam assembly 14052 and the upper casing cutter segments 14054 with the lower casing cutter segments 14058 and the lower cam assembly 14060.

[00134] In particular, as illustrated in Fig. 11W, anytime the upper toggle links, 14022 and 14028, and lower toggle links, 14024 and 14030, are positioned within a portion of the

expandable wellbore casing 100 that has been radially expanded and plastically deformed by the system 10, the triggers, 14026 and 14032, will be pivoted by the engagement arms, 14024d and 14030d, of the lower toggle links, 14024 and 14030, to a position in which the triggers will no longer engage the internal flange 14034d of the end of the tubular spring housing 14034 thereby permitting the displacement of the tubular spring housing in the direction 14096. As a result, the upper cam assembly 14052 and the upper casing cutter segments 14054 can be brought into engagement with the lower casing cutter segments 14058 and the lower cam assembly 14060. In an exemplary embodiment, the upper toggle links, 14022 and 14028, and the lower toggle links, 14024 and 14030, are spring biased towards the position illustrated in Fig. 11W.

[00135] Conversely, as illustrated in Fig. 11X, anytime the upper toggle links, 14022 and 14028, and lower toggle links, 14024 and 14030, are positioned within a portion of the expandable wellbore casing 100 that has not been radially expanded and plastically deformed by the system 10, the triggers, 14026 and 14032, will be maintained in a position in which the triggers will engage the internal flange 14034d of the end of the tubular spring housing 14034 thereby preventing the displacement of the tubular spring housing in the direction 14096. As a result, the upper cam assembly 14052 and the upper casing cutter segments 14054 cannot be brought into engagement with the lower casing cutter segments 14058 and the lower cam assembly 14060. In an exemplary embodiment, the triggers, 14026 and 14032, are spring biased towards the position illustrated in Fig. 11X.

[00136] In an exemplary embodiment, as illustrated in Fig. 11Y, the tubular spring housing 14034 may be displaced upwardly in the direction 14098 even if the upper toggle links, 14022 and 14028, and lower toggle links, 14024 and 14030, are positioned within a portion of the expandable wellbore casing 100 that has not been radially expanded and plastically deformed by the system 10.

[00137] In an exemplary embodiment, as illustrated in Figs. 11Z1 to 11Z4, 11AA1 to 11AA4, 11AB1 to 11AB4, 11AC1 to 11AC4, 11AD, and 11AE, the tubular spring housing 14034 of the casing cutter assembly 14 defines internal annular recesses 14034k and 14034l, spaced apart by an internal flange 14034m, the tubular toggle bushing 14008 defines an external annular recess 14008ac, and the casing cutter assembly further includes pins, 14100a and 14100b and 14102a and 14102b, mounted in holes 14008j and 14008o and 14008k and 14008n, respectively, of the tubular toggle bushing, and a one-shot deactivation device 14104 mounted on the tubular toggle bushing between the pins, 14100a and 14100b and 14102a and 14102b.

[00138] The one-shot deactivation device 14104 includes a tubular body 14104a that defines radial holes, 14104b and 14014c, and includes an external annular recess 14104d at one end, a centrally positioned external flange 14104e, a centrally positioned internal

annular recess 14104f, and an external annular recess 14104g at another end. An engagement member 14106 that includes a base member 14106a having a tapered end 14106b and a key member 14106c having a tapered end 14106d is received within a portion of the internal annular recess 14104f of the tubular body 14104a and an engagement member 14108 that includes a base member 14108a having a tapered end 14108b and a key member 14108c having a tapered end 14108d is received within an opposite portion of the internal annular recess 14104f of the tubular body 14104a. Spring members, 14110 and 14112, are received within the annular recess 14104f of the tubular body 14104a for biasing the base members, base member 14106a and 14108a, of the engagement members, 14106 and 14108, respectively, radially inwardly relative to the tubular body 14104a.

[00139] In an exemplary embodiment, during operation of the casing cutter assembly 14, as illustrated in Figs. 11Z1 to 11Z4, the one-shot deactivation device 14104 are positioned proximate and in intimate contact with the pins, 14102a and 14102b, with the tapered ends, 14106b and 14108b, of the base members, 14106a and 14108a, of the engagement members, 14106 and 14108, received within the external annular recess 14008ac of the tubular toggle bushing 14008. When the one-shot deactivation device 14104 is positioned as illustrated in Fig. 11Z, the external annular recess 14104d of the tubular body 14104a of the one-shot deactivation device is moved out of engagement with the engagement arms, 14026d and 14032d, of the triggers, 14026 and 14032, respectively. As a result, the triggers, 14026 and 14032, may operate normally as described above with reference to Figs. 11W, 11X, and 11Y.

[00140] Conversely, in an exemplary embodiment, during operation of the casing cutter assembly 14, as illustrated in Figs. 11AA1 to 11AA4, the one-shot deactivation device 14104 are positioned proximate and in intimate contact with the pins, 14100a and 14100b, with the tapered ends, 14106b and 14108b, of the base members, 14106a and 14108a, of the engagement members, 14106 and 14108, not received within the external annular recess 14008ac of the tubular toggle bushing 14008. When the one-shot deactivation device 14104 is positioned as illustrated in Figs. 11AA1 to 11AA4, the external annular recess 14104d of the tubular body 14104a of the one-shot deactivation device is moved into engagement with the engagement arms, 14026d and 14032d, of the triggers, 14026 and 14032, respectively. As a result, the triggers, 14026 and 14032, are deactivated and may not operate normally as described above with reference to Figs. 11W, 11X, and 11Y.

[00141] In an alternative embodiment, the elements of the casing cutter assembly 14 that sense the diameter of the expandable wellbore casing 100 may be disabled or omitted or adjusted to sense any pre-selected internal diameter of the expandable wellbore casing.

[00142] In an exemplary embodiment, the ball gripper assembly 16 is provided and operates substantially, at least in part, as disclosed in one or more of the following: (1) PCT

patent application serial number PCT/US03/29859, attorney docket no. 25791.102.02, filed on 9/22/2003, (2) PCT patent application serial number PCT/US03/14153, attorney docket number 25791.104.02, filed on 11/13/2003, and/or (3) PCT patent application serial number PCT/US04/_____, attorney docket number 25791.253.02, filed on 3/11/2004, and/or (4) PCT patent application serial number PCT/US04/_____, attorney docket number 25791.260, filed on 3/26/2004, the disclosures of which are incorporated herein by reference.

[00143] In an exemplary embodiment, as illustrated in Figs. 12A1 to 12A4, 12B and 12C1 to 12C4, the ball gripper assembly 16 includes an upper mandrel 1602 that defines a longitudinal passage 1602a and a radial passage 1602b and includes an internal threaded connection 1602c at one end, an external flange 1602d at an intermediate portion that includes an external annular recess 1602e having a shoulder 1602f and an external radial hole 1602g, an external annular recess 1602h, an external annular recess 1602i, an external annular recess 1602j having a tapered end 1602k including an external annular recess 1602ka, an external annular recess 1602l, and an external annular recess 1602m, and an external annular recess 1602n, an external radial hole 1602o, an external annular recess 1602p, and an external annular recess 1602q at another end.

[00144] An upper tubular bushing 1604 defines an internally threaded radial opening 1604a and includes an external flange 1604b having an external annular recess 1604c and an internal annular recess 1604d mates with and receives the external flange 1602d of the upper mandrel 1602. In particular, the internal annular recess 1604d of the upper tubular bushing 1604 mates with the shoulder 1602f of the external annular recess 1602e of the upper mandrel 1602. A screw 1606 that is threadably coupled to the internally threaded radial opening 1604a of the upper tubular bushing 1604 extends into the external radial hole 1602g of the external flange 1602d of the upper mandrel 1602.

[00145] A deactivation tubular sleeve 1608 defines a radial passage 1608a and includes an internal annular recess 1608b that mates with and receives an end of the external annular recess 1604c of the external flange 1604b of the upper tubular bushing 1604, an internal annular recess 1608c that mates with and receives the external flange 1602d of the upper mandrel 1602, an internal annular recess 1608d, an internal annular recess 1608e, and an internal annular recess 1608f. A deactivation spring 1610 is received within an annulus 1612 defined between the internal annular recess 1608b of the deactivation tubular sleeve 1608, an end face of the external annular recess 1604c of the external flange 1604b of the upper tubular bushing 1604, and the external annular recess 1602h of the external flange 1602d of the upper mandrel 1602.

[00146] A sealing member 1614 is received with the external annular recess 1602i of the external flange 1602d of the upper mandrel 1602 for sealing the interface between the

upper mandrel and the deactivation tubular sleeve 1608. An annular spacer element 1616 is received within the external annular recess 1602ka of the tapered end 1602k of the external annular recess 1602j of the upper mandrel 1602.

[00147] One or more inner engagement elements 1618a of a tubular coglet 1618 engage and are received within the external annular recess 1602ka of the tapered end 1602k of the external annular recess 1602j of the upper mandrel 1602 and one or more outer engagement elements 1618b of the coglet engage and are received within the internal annular recess 1608d of the deactivation tubular sleeve 1608.

[00148] An external annular recess 1620a of an end of a tubular coglet prop 1620 that includes an inner flange 1620b receives and mates with the inner surfaces of the outer engagement elements 1618b of the coglet 1618. The end of the tubular coglet prop 1620 further receives and mates with the external annular recess 1602j of the external flange 1602d of the upper mandrel 1602. A sealing element 1622 is received within the external annular recess 1602l of the upper mandrel 1602 for sealing the interface between the upper mandrel and the tubular coglet prop 1620.

[00149] An end of a tubular bumper sleeve 1624 that includes internal and external flanges, 1624a and 1624b, and a hole 1624c at another end mates with and receives the external annular recess 1602m of the external flange 1602d of the upper mandrel 1602. A coglet spring 1626 is received within an annulus 1628 defined between the external annular recess 1602m of the external flange 1602d of the upper mandrel 1602, the tubular coglet prop 1620, the inner flange 1620b of the tubular coglet prop, an end face of the tubular bumper sleeve 1624, and the internal annular recess 1608c of the deactivation tubular sleeve 1608.

[00150] A tubular ball race 1628 that defines a plurality of tapered annular recesses 1628a and an internally threaded radial opening 1628b and includes one or more axial engagement elements 1628c at one end and one or more axial engagement elements 1628d at another end receives and mates with the other end of the upper mandrel 1602. In an exemplary embodiment, the axial engagement elements 1628c of the tubular ball race 1628 are received within and are coupled to the hole 1624c of the tubular bumper sleeve 1624. An end of a tubular activation sleeve 1630 that defines a plurality of radial openings 1630a, a radial opening 1630b, a radial opening 1630c, and includes an internal annular recess 1630d receives and mates with the tubular ball race 1628. In an exemplary embodiment, an end face of an end of the tubular activation sleeve 1630 is positioned proximate and in opposing relation to an end face of an end of the deactivation sleeve 1608. In an exemplary embodiment, the radial openings 1630a are aligned with and positioned in opposing relation to corresponding of tapered annular recesses 1628a of the tubular ball race 1628, and the radial openings are also narrowed in cross section in the radial direction

for reasons to be described.

[00151] Balls 1632 are received within each of the of tapered annular recesses 1628a and corresponding radial openings 1630a of the tubular ball race 1628 and tubular activation sleeve 1630, respectively. In an exemplary embodiment, the narrowed cross sections of the radial openings 1630a of the tubular activation sleeve 1630 will permit the balls 1632 to be displaced outwardly in the radial direction until at least a portion of the balls extends beyond the outer perimeter of the tubular activation sleeve to thereby permit engagement of the balls with an outer structure such as, for example, a wellbore casing.

[00152] A lower mandrel 1634 that defines a longitudinal passage 1634a and an internally threaded radial passage 1634b at one end and includes internal annular recesses, 1634c and 1634d, for receiving and mating with the external annular recesses, 1602p and 1602q, of the upper mandrel 1602, an internal annular recess 1634e, an external flange 1634f, and an externally threaded connection 1634g at another end. In an exemplary embodiment, as illustrated in Fig. 12B, the end of the lower mandrel 1634 further includes longitudinal recesses 1634h for receiving and mating with corresponding axial engagement elements 1628d of the tubular ball race 1628. A sealing element 1635 is received within the internal annular recess 1634d of the lower mandrel 1634 for sealing an interface between the lower mandrel and the external annular recess 1602p of the upper mandrel 1602.

[00153] A tubular spring retainer 1636 that defines a radial passage 1636a and includes an external annular recess 1636b at one end mates with and receives the end of the lower mandrel 1634 and is positioned proximate an end face of the external flange 1634f of the lower mandrel. A tubular spring retainer 1638 receives and mates with the end of the lower mandrel 1634 and is received and mates with the internal annular recess 1630d of the tubular activation sleeve 1630.

[00154] An activation spring 1640 is received within an annulus 1642 defined an end face of the tubular spring retainer 1638, an end face of the spring retainer 1636, the internal annular recess 1630d of the tubular activation sleeve 1630, and the end of the lower mandrel 1634. A retainer screw 1642 is received within and is threadably coupled to the internally threaded radial opening 1634b of the lower mandrel 1634 that also extends into the external radial hole 1602o of the upper mandrel 1602.

[00155] During operation of the ball gripper assembly 16, in an exemplary embodiment, as illustrated in Figs. 12A1 to 12A4, the ball gripper assembly may be positioned within the expandable wellbore casing 100 and the internally threaded connection 1602c of the upper mandrel 1602 may be coupled to an externally threaded connection 14a of an end of the casing cutter assembly 14 and the externally threaded connection 1634g of the lower mandrel 1634 may be coupled to an internally threaded connection 18a of an end of the tension actuator assembly 18.

[00156] In an alternative embodiment, the internally threaded connection 1602c of the upper mandrel 1602 may be coupled to an externally threaded connection of an end of the tension actuator assembly 18 and the externally threaded connection 1634g of the lower mandrel 1634 may be coupled to an internally threaded connection of an end of casing cutter assembly 14.

[00157] In an exemplary embodiment, the deactivation spring 1610 has a greater spring rate than the activation spring 1640. As a result, in an initial operating mode, as illustrated in Figs. 12A1 to 12A4, a biasing spring force is applied to the deactivation sleeve 1608 and activation sleeve 1630 in a direction 1644 that maintains the activation sleeve in a position relative to the tubular ball race 1628 that maintains the balls 1632 within the radially inward portions of the corresponding tapered annular recesses 1628a of the tubular ball race such that the balls do not extend beyond the perimeter of the activation sleeve to engage the expandable wellbore casing 100.

[00158] As illustrated in Figs. 12C1 to 12C4, in an exemplary embodiment, the ball gripper 16 may be operated to engage the interior surface of the expandable wellbore casing 100 by injecting a fluidic material 1650 into the ball gripper assembly through the longitudinal passages 1602a and 1634aa, of the upper and lower mandrels, 1602 and 1634, respectively.

[00159] In particular, when the longitudinal and radial passages, 1602a and 1602b, respectively, of the upper mandrel 1602 are pressurized by the injection of the fluidic material 1650, the internal annular recess 1608c of the deactivation tubular sleeve 1608 is pressurized. When the operating pressure of the fluidic material 1650 within the internal annular recess 1608c of the deactivation tubular sleeve 1608 is sufficient to overcome the biasing spring force of the deactivation spring 1610, the deactivation tubular sleeve is displaced in a direction 1652. As a result, the spring force provided by the activation spring 1640 then may displace the activation tubular sleeve 1630 in the direction 1652 thereby moving the balls 1632 on the corresponding tapered annular recesses 1628a of the tubular ball race 1628 outwardly in a radial direction into engagement with the interior surface of the expandable wellbore casing 100. In an exemplary embodiment, the operating pressure of the fluidic material 1650 sufficient to overcome the biasing spring force of the deactivation spring 1610 was about 100 psi.

[00160] In an exemplary embodiment, when the operating pressure of the fluidic material 1650 is reduced, the operating pressure of the fluidic material 1650 within the internal annular recess 1608c of the deactivation tubular sleeve 1608 is no longer sufficient to overcome the biasing spring force of the deactivation spring 1610, and the deactivation tubular sleeve and the activation tubular sleeve 1630 are displaced in a direction opposite to

the direction 1652 thereby moving the balls 1632 radially inwardly and out of engagement with the interior surface of the expandable wellbore casing 100.

[00161] In an exemplary embodiment, the ball gripper assembly 16 is operated to engage the interior surface of the expandable wellbore casing 100 in combination with the operation of the tension actuator assembly 18 to apply an upward tensile force to one or more elements of the system 10 coupled to and positioned below the tension actuator assembly. As a result, a reaction force comprising a downward tensile force is applied to the lower mandrel 1634 of the ball gripper assembly 16 in a direction opposite to the direction 1652 during the operation of the tension actuator assembly 18. Consequently, due to the geometry of the tapered 1628a of the tubular ball race 1628, the balls 1632 are driven up the tapered annular recesses 1628a of the tubular ball race 1628 with increased force and the contact force between the balls 1632 and the interior surface of the expandable wellbore casing 100 is significantly increased thereby correspondingly increasing the gripping force and effect of the ball gripper assembly.

[00162] In an exemplary embodiment, the ball gripper assembly 16 may be operated to radially expand and plastically deform discrete portions of the expandable wellbore casing 100 by controlling the amount of contact force applied to the interior surface of the expandable wellbore casing by the balls 1632 of the ball gripper assembly. In an experimental test of an exemplary embodiment of the ball gripper assembly 16, an expandable wellbore casing was radially expanded and plastically deformed. This was an unexpected result.

[00163] In an exemplary embodiment, the tension actuator assembly 18 operates and is provided substantially, at least in part, as disclosed in one or more of the following: (1) PCT patent application serial number PCT/US02/36267, attorney docket number 25791.88.02, filed on 11/12/2002, (2) PCT patent application serial number PCT/US03/29859, attorney docket no. 25791.102.02, filed on 9/22/2003, (3) PCT patent application serial number PCT/US03/14153, attorney docket number 25791.104.02, filed on 11/13/2003, (4) PCT patent application serial number PCT/US03/29460, attorney docket number 25791.114.02, filed on 9/23/2003, and/or (5) PCT patent application serial number PCT/US04/_____, attorney docket number 25791.253.02, filed on 3/11/2004, and/or (6) PCT patent application serial number PCT/US04/_____, attorney docket number 25791.260, filed on 3/26/2004, the disclosures of which are incorporated herein by reference.

[00164] In an exemplary embodiment, as illustrated in Figs. 13A1 to 13A8 and 13B1 to 13B7, the tension actuator assembly 18 includes an upper tubular support member 18002 that defines a longitudinal passage 18002a, and external internally threaded radial openings, 18002b and 18002c, and an external annular recess 18002d and includes an internally

threaded connection 18002e at one end and an external flange 18002f, an external annular recess 18002g having an externally threaded connection, and an internal annular recess 18002h having an internally threaded connection at another end. An end of a tubular actuator barrel 18004 that defines radial passages, 18004a and 18004b, at one end and radial passages, 18004c and 18004d, includes an internally threaded connection 18004e at one end that mates with, receives, and is threadably coupled to the external annular recess 18002g of the upper tubular support member 18002 and abuts and end face of the external flange 18002f of the upper tubular support member and an internally threaded connection 18004f at another end.

[00165] Torsional locking pins, 18006a and 18006b, are coupled to and mounted within the external radial mounting holes, 18002b and 18002c, respectively, of the upper tubular support member and received within the radial passages, 18004a and 18004b, of the end of the tubular actuator barrel 18004. The other end of the tubular actuator barrel 18004 receives and is threadably coupled to an end of a tubular barrel connector 18008 that defines an internal annular recess 18008a, external radial mounting holes, 18008b and 18008c, radial passages, 18008d and 18008e, and external radial mounting holes, 18008f and 18008g and includes circumferentially spaced apart teeth 18008h at one end. A sealing cartridge 18010 is received within and coupled to the internal annular recess 18008a of the tubular barrel connector 18008 for fluidicly sealing the interface between the tubular barrel connector and the sealing cartridge. Torsional locking pins, 18012a and 18012b, are coupled to and mounted within the external radial mounting holes, 18008b and 18008c, respectively, of the tubular barrel connector 18008 and received within the radial passages, 18004c and 18004d, of the tubular actuator barrel 18004.

[00166] A tubular member 18014 that defines a longitudinal passage 18014a having one or more internal splines 18014b at one end and circumferentially spaced apart teeth 18014c at another end for engaging the circumferentially spaced apart teeth 18008h of the tubular barrel connector 18008 mates with and is received within the actuator barrel 18004 and the one end of the tubular member abuts an end face of the other end of the upper tubular support member 18002 and at another end abuts and end face of the tubular barrel connector 18008. A tubular guide member 18016 that defines a longitudinal passage 18016a having a tapered opening 18016aa, and radial passages, 18016b and 18016c, includes an external flange 18016d having an externally threaded connection at one end that is received within and coupled to the internal annular recess 18002h of the upper tubular support member 18002.

[00167] The other end of the tubular barrel connector 18008 is threadably coupled to and is received within an end of a tubular actuator barrel 18018 that defines a longitudinal passage 18018a, radial passages, 18018b and 18018c, and radial passages, 18018d and

18018e. Torsional locking pins, 18020a and 18020b, are coupled to and mounted within the external radial mounting holes, 18008f and 18008g, respectively, of the tubular barrel connector 18008 and received within the radial passages, 18018b and 18018c, of the tubular actuator barrel 18018. The other end of the tubular actuator barrel 18018 receives and is threadably coupled to an end of a tubular barrel connector 18022 that defines an internal annular recess 18022a, external radial mounting holes, 18022b and 18022c, radial passages, 18022d and 18022e, and external radial mounting holes, 18022f and 18022g. A sealing cartridge 18024 is received within and coupled to the internal annular recess 18022a of the tubular barrel connector 18022 for fluidicly sealing the interface between the tubular barrel connector and the sealing cartridge. Torsional locking pins, 18024a and 18024b, are coupled to and mounted within the external radial mounting holes, 18022b and 18022c, respectively, of the barrel connector 18022 and received within the radial passages, 18018d and 18018e, of the tubular actuator barrel 18018.

[00168] The other end of the tubular barrel connector 18022 is threadably coupled to and is received within an end of a tubular actuator barrel 18026 that defines a longitudinal passage 18026a, radial passages, 18026b and 18026c, and radial passages, 18026d and 18026e. Torsional locking pins, 18028a and 18028b, are coupled to and mounted within the external radial mounting holes, 18022f and 18022g, respectively, of the tubular barrel connector 18022 and received within the radial passages, 18026b and 18026c, of the tubular actuator barrel 18026. The other end of the tubular actuator barrel 18026 receives and is threadably coupled to an end of a tubular barrel connector 18030 that defines an internal annular recess 18030a, external radial mounting holes, 18030b and 18030c, radial passages, 18030d and 18030e, and external radial mounting holes, 18030f and 18030g. A sealing cartridge 18032 is received within and coupled to the internal annular recess 18030a of the tubular barrel connector 18030 for fluidicly sealing the interface between the tubular barrel connector and the sealing cartridge. Torsional locking pins, 18034a and 18034b, are coupled to and mounted within the external radial mounting holes, 18030b and 18030c, respectively, of the tubular barrel connector 18030 and received within the radial passages, 18026d and 18026e, of the tubular actuator barrel 18026.

[00169] The other end of the tubular barrel connector 18030 is threadably coupled to and is received within an end of a tubular actuator barrel 18036 that defines a longitudinal passage 18036a, radial passages, 18036b and 18036c, and radial passages, 18036d and 18036e. Torsional locking pins, 18038a and 18038b, are coupled to and mounted within the external radial mounting holes, 18030f and 18030g, respectively, of the tubular barrel connector 18030 and received within the radial passages, 18036b and 18036c, of the tubular actuator barrel 18036. The other end of the tubular actuator barrel 18036 receives and is threadably coupled to an end of a tubular barrel connector 18040 that defines an internal

annular recess 18040a, external radial mounting holes, 18040b and 18040c, radial passages, 18040d and 18040e, and external radial mounting holes, 18040f and 18040g. A sealing cartridge 18042 is received within and coupled to the internal annular recess 18040a of the tubular barrel connector 18040 for fluidicly sealing the interface between the tubular barrel connector and the sealing cartridge. Torsional locking pins, 18044a and 18044b, are coupled to and mounted within the external radial mounting holes, 18040b and 18040c, respectively, of the tubular barrel connector 18040 and received within the radial passages, 18036d and 18036e, of the tubular actuator barrel 18036.

[00170] The other end of the tubular barrel connector 18040 is threadably coupled to and is received within an end of a tubular actuator barrel 18046 that defines a longitudinal passage 18046a, radial passages, 18046b and 18046c, and radial passages, 18046d and 18046e. Torsional locking pins, 18048a and 18048b, are coupled to and mounted within the external radial mounting holes, 18040f and 18040g, respectively, of the tubular barrel connector 18040 and received within the radial passages, 18046b and 18046c, of the tubular actuator barrel 18046. The other end of the tubular actuator barrel 18046 receives and is threadably coupled to an end of a tubular barrel connector 18050 that defines an internal annular recess 18050a, external radial mounting holes, 18050b and 18050c, radial passages, 18050d and 18050e, and external radial mounting holes, 18050f and 18050g. A sealing cartridge 18052 is received within and coupled to the internal annular recess 18050a of the tubular barrel connector 18050 for fluidicly sealing the interface between the tubular barrel connector and the sealing cartridge. Torsional locking pins, 18054a and 18054b, are coupled to and mounted within the external radial mounting holes, 18050b and 18050c, respectively, of the tubular barrel connector 18050 and received within the radial passages, 18046d and 18046e, of the tubular actuator barrel 18046.

[00171] The other end of the tubular barrel connector 18050 is threadably coupled to and is received within an end of a tubular actuator barrel 18056 that defines a longitudinal passage 18056a, radial passages, 18056b and 18056c, and radial passages, 18056d and 18056e. Torsional locking pins, 18058a and 18058b, are coupled to and mounted within the external radial mounting holes, 18050f and 18050g, respectively, of the tubular barrel connector 18050 and received within the radial passages, 18056b and 18056c, of the tubular actuator barrel 18056. The other end of the tubular actuator barrel 18056 receives and is threadably coupled to an end of a tubular lower stop 18060 that defines an internal annular recess 18060a, external radial mounting holes, 18060b and 18060c, and an internal annular recess 18060d that includes one or more circumferentially spaced apart locking teeth 18060e at one end and one or more circumferentially spaced apart locking teeth 18060f at the other end. A sealing cartridge 18062 is received within and coupled to the internal annular recess 18060a of the tubular lower stop 18060 for fluidicly sealing the interface

between the tubular lower stop and the sealing cartridge. Torsional locking pins, 18064a and 18064b, are coupled to and mounted within the external radial mounting holes, 18060b and 18060c, respectively, of the tubular lower stop 18060 and received within the radial passages, 18056d and 18056e, of the tubular actuator barrel 18056.

[00172] A connector tube 18066 that defines a longitudinal passage 18066a and radial mounting holes, 18066b and 18066c, and includes external splines 18066d at one end for engaging the internal splines 18014b of the tubular member 18014 and radial mounting holes, 18066e and 18066f, at another end is received within and sealingly and movably engages the interior surface of the sealing cartridge 18010 mounted within the annular recess 18008a of the tubular barrel connector 18008. In this manner, during longitudinal displacement of the connector tube 18066 relative to the tubular barrel connector 18008, a fluidic seal is maintained between the exterior surface of the connector tube and the interior surface of the tubular barrel connector. An end of the connector tube 18066 also receives and mates with the other end of the tubular guide member 18016. Mounting screws, 18068a and 18068b, are coupled to and received within the radial mounting holes, 18066b and 18066c, respectively of the connector tube 18066.

[00173] The other end of the connector tube 18066 is received within and threadably coupled to an end of a tubular piston 18070 that defines a longitudinal passage 18070a, radial mounting holes, 18070b and 18070c, radial passages, 18070d and 18070e, and radial mounting holes, 18070f and 18070g, that includes a flange 18070h at one end. A sealing cartridge 18072 is mounted onto and sealingly coupled to the exterior of the tubular piston 18070 proximate the flange 18070h. The sealing cartridge 18072 also mates with and sealingly engages the interior surface of the tubular actuator barrel 18018. In this manner, during longitudinal displacement of the tubular piston 18070 relative to the actuator barrel 18018, a fluidic seal is maintained between the exterior surface of the piston and the interior surface of the actuator barrel. Mounting screws, 18074a and 18074b, are coupled to and mounted within the external radial mounting holes, 18070b and 18070c, respectively, of the tubular piston 18070 and received within the radial passages, 18066e and 18066f, of the connector tube 18066.

[00174] The other end of the tubular piston 18070 receives and is threadably coupled to an end of a connector tube 18076 that defines a longitudinal passage 18076a, radial mounting holes, 18076b and 18076c, at one end and radial mounting holes, 18076d and 18076e, at another end. The connector tube 18076 is received within and sealingly and movably engages the interior surface of the sealing cartridge 18024 mounted within the annular recess 18022a of the tubular barrel connector 18022. In this manner, during longitudinal displacement of the connector tube 18076 relative to the tubular barrel connector 18022, a fluidic seal is maintained between the exterior surface of the connector

tube and the interior surface of the barrel connector. Mounting screws, 18078a and 18078b, are coupled to and mounted within the external radial mounting holes, 18070f and 18070g, respectively, of the tubular piston 18070 and received within the radial passages, 18076b and 18076c, of the connector tube 18076.

[00175] The other end of the connector tube 18076 is received within and threadably coupled to an end of a tubular piston 18080 that defines a longitudinal passage 18080a, radial mounting holes, 18080b and 18080c, radial passages, 18080d and 18080e, and radial mounting holes, 18080f and 18080g, that includes a flange 18080h at one end. A sealing cartridge 18082 is mounted onto and sealingly coupled to the exterior of the tubular piston 18080 proximate the flange 18080h. The sealing cartridge 18082 also mates with and sealingly engages the interior surface of the tubular actuator barrel 18026. In this manner, during longitudinal displacement of the tubular piston 18080 relative to the tubular actuator barrel 18026, a fluidic seal is maintained between the exterior surface of the piston and the interior surface of the actuator barrel. Mounting screws, 18084a and 18084b, are coupled to and mounted within the external radial mounting holes, 18080b and 18080c, respectively, of the tubular piston 18080 and received within the radial passages, 18076e and 18076f, of the connector tube 18076.

[00176] The other end of the tubular piston 18080 receives and is threadably coupled to an end of a connector tube 18086 that defines a longitudinal passage 18086a, radial mounting holes, 18086b and 18086c, at one end and radial mounting holes, 18086d and 18086e, at another end. The connector tube 18086 is received within and sealingly and movably engages the interior surface of the sealing cartridge 18032 mounted within the annular recess 18030a of the tubular barrel connector 18030. In this manner, during longitudinal displacement of the connector tube 18086 relative to the tubular barrel connector 18030, a fluidic seal is maintained between the exterior surface of the connector tube and the interior surface of the barrel connector. Mounting screws, 18088a and 18088b, are coupled to and mounted within the external radial mounting holes, 18080f and 18080g, respectively, of the tubular piston 18080 and received within the radial passages, 18086b and 18086c, of the connector tube 18086.

[00177] The other end of the connector tube 18086 is received within and threadably coupled to an end of a tubular piston 18090 that defines a longitudinal passage 18090a, radial mounting holes, 18090b and 18090c, radial passages, 18090d and 18090e, and radial mounting holes, 18090f and 18090g, that includes a flange 18090h at one end. A sealing cartridge 18092 is mounted onto and sealingly coupled to the exterior of the tubular piston 18090 proximate the flange 18090h. The sealing cartridge 18092 also mates with and sealingly engages the interior surface of the tubular actuator barrel 18036. In this manner, during longitudinal displacement of the tubular piston 18090 relative to the tubular actuator

barrel 18036, a fluidic seal is maintained between the exterior surface of the piston and the interior surface of the actuator barrel. Mounting screws, 18094a and 18094b, are coupled to and mounted within the external radial mounting holes, 18090b and 18090c, respectively, of the tubular piston 18090 and received within the radial passages, 18086e and 18086f, of the connector tube 18086.

[00178] The other end of the tubular piston 18090 receives and is threadably coupled to an end of a connector tube 18096 that defines a longitudinal passage 18096a, radial mounting holes, 18096b and 18096c, at one end and radial mounting holes, 18096d and 18096e, at another end. The connector tube 18096 is received within and sealingly and movably engages the interior surface of the sealing cartridge 18042 mounted within the annular recess 18040a of the tubular barrel connector 18040. In this manner, during longitudinal displacement of the connector tube 18096 relative to the tubular barrel connector 18040, a fluidic seal is maintained between the exterior surface of the connector tube and the interior surface of the barrel connector. Mounting screws, 18098a and 18098b, are coupled to and mounted within the external radial mounting holes, 18090f and 18090g, respectively, of the tubular piston 18090 and received within the radial passages, 18096b and 18096c, of the connector tube 18096.

[00179] The other end of the connector tube 18096 is received within and threadably coupled to an end of a tubular piston 18100 that defines a longitudinal passage 18100a, radial mounting holes, 18100b and 18100c, radial passages, 18100d and 18100e, and radial mounting holes, 18100f and 18100g, that includes a flange 18100h at one end. A sealing cartridge 18102 is mounted onto and sealingly coupled to the exterior of the tubular piston 18100 proximate the flange 18100h. The sealing cartridge 18102 also mates with and sealingly engages the interior surface of the tubular actuator barrel 18046. In this manner, during longitudinal displacement of the tubular piston 18100 relative to the tubular actuator barrel 18046, a fluidic seal is maintained between the exterior surface of the piston and the interior surface of the actuator barrel. Mounting screws, 18104a and 18104b, are coupled to and mounted within the external radial mounting holes, 18100b and 18100c, respectively, of the tubular piston 18100 and received within the radial passages, 18096e and 18096f, of the connector tube 18096.

[00180] The other end of the tubular piston 18100 receives and is threadably coupled to an end of a connector tube 18106 that defines a longitudinal passage 18106a, radial mounting holes, 18106b and 18106c, at one end and radial mounting holes, 18106d and 18106e, at another end. The connector tube 18106 is received within and sealingly and movably engages the interior surface of the sealing cartridge 18052 mounted within the annular recess 18050a of the tubular barrel connector 18050. In this manner, during longitudinal displacement of the connector tube 18106 relative to the tubular barrel

connector 18050, a fluidic seal is maintained between the exterior surface of the connector tube and the interior surface of the barrel connector. Mounting screws, 18108a and 18108b, are coupled to and mounted within the external radial mounting holes, 18100f and 18100g, respectively, of the tubular piston 18100 and received within the radial passages, 18106b and 18106c, of the connector tube 18106.

[00181] The other end of the connector tube 18106 is received within and threadably coupled to an end of a tubular piston 18110 that defines a longitudinal passage 18110a, radial mounting holes, 18110b and 18110c, radial passages, 18110d and 18110e, radial mounting holes, 18110f and 18110g, that includes a flange 18110h at one end and circumferentially spaced teeth 18110i at another end for engaging the one or more circumferentially spaced apart locking teeth 18060e of the tubular lower stop 18060. A sealing cartridge 18112 is mounted onto and sealingly coupled to the exterior of the tubular piston 18110 proximate the flange 18110h. The sealing cartridge 18112 also mates with and sealingly engages the interior surface of the actuator barrel 18056. In this manner, during longitudinal displacement of the tubular piston 18110 relative to the actuator barrel 18056, a fluidic seal is maintained between the exterior surface of the piston and the interior surface of the actuator barrel. Mounting screws, 18114a and 18114b, are coupled to and mounted within the external radial mounting holes, 18110b and 18110c, respectively, of the tubular piston 18110 and received within the radial passages, 18106d and 18106e, of the connector tube 18106.

[00182] The other end of the tubular piston 18110 receives and is threadably coupled to an end of a connector tube 18116 that defines a longitudinal passage 18116a, radial mounting holes, 18116b and 18116c, at one end and radial mounting holes, 18116d and 18116e, at another end that includes an external flange 18116f that includes circumferentially spaced apart teeth 18116g that extend from an end face of the external flange for engaging the teeth 18060f of the tubular lower stop 18060, and an externally threaded connection 18116h at another end. The connector tube 18116 is received within and sealingly and movably engages the interior surface of the sealing cartridge 18062 mounted within the annular recess 18060a of the lower tubular stop 18060. In this manner, during longitudinal displacement of the connector tube 18116 relative to the lower tubular stop 18060, a fluidic seal is maintained between the exterior surface of the connector tube and the interior surface of the lower tubular stop. Mounting screws, 18118a and 18118b, are coupled to and mounted within the external radial mounting holes, 18110f and 18110g, respectively, of the tubular piston 18110 and received within the radial passages, 18116b and 18116c, of the connector tube 18116.

[00183] In an exemplary embodiment, as illustrated in Figs. 13A1 to 13A8, the internally threaded connection 18002e of the upper tubular support member 18002 receives

and is coupled to the externally threaded connection 1234g of the lower mandrel 1234 of the ball grabber assembly 16 and the externally threaded connection 18116h of the connector tube 18116 is received within and is coupled to an internally threaded connection 20a of an end of the safety sub assembly 20.

[00184] In an exemplary embodiment, as illustrated in Figs. 13A1 to 13A8, during operation of the tension actuator assembly 18, the tension actuator assembly is positioned within the expandable wellbore casing 100 and fluidic material 18200 is injected into the tension actuator assembly through the passages 18002a, 18016a, 18066a, 18070a, 18076a, 18080a, 18086a, 18090a, 18096a, 18100a, 18106a, 18110a, and 18116a. The injected fluidic material 18200 will also pass through the radial passages, 18070d and 18070e, 18080d and 18080e, 18090d and 18090e, 18100d and 18100e, 18110d and 18110e, of the tubular pistons, 18070, 18080, 18090, 18100, and 18110, respectively, into annular piston chambers, 18202, 18204, 18206, 18208, 18208, and 18210.

[00185] As illustrated in Figs. 13B1 to 13B7, the operating pressure of the fluidic material 18200 may then be increased by, for example, controllably blocking or limiting the flow of the fluidic material through the passage 18116a and/or increasing the operating pressure of the outlet of a pumping device for injecting the fluidic material 18200 into the tension actuator assembly 18. As a result, of the increased operating pressure of the fluidic material 18200 within the tension actuator assembly 18, the operating pressures of the annular piston chambers, 18202, 18204, 18206, 18208, 18208, and 18210, will be increased sufficiently to displace the tubular pistons, 18070, 18080, 18090, 18100, and 18110, upwardly in the direction 18212 thereby also displacing the connector tube 18116. As a result, a upward tensile force is applied to all elements of the system 10 coupled to and positioned below the connector tube 18116. In an exemplary embodiment, during the upward displacement of the tubular pistons, 18070, 18080, 18090, 18100, and 18110, fluidic materials displaced by the tubular pistons within discharge annular chambers, 18214, 18216, 18218, 18220, and 18222 are exhausted out of the tension actuator assembly 18 through the radial passages, 18008d and 18008e, 18022d and 18022e, 18030d and 18030e, 18040d and 18040e, 18050d and 18050e, respectively. Furthermore, in an exemplary embodiment, the upward displacement of the tubular pistons, 18070, 18080, 18090, 18100, and 18110, further causes the external splines 18066d of the connector tube 18066 to engage the internal splines 18014b of the tubular member 18014 and the circumferentially spaced apart teeth 18116g of the connector tube 18116 to engage the circumferentially spaced teeth 18060f of the tubular lower stop 18060. As a result of the interaction of the external splines 18066d of the connector tube 18066 to engage the internal splines 18014b of the tubular member 18014 and the circumferentially spaced apart teeth 18116g of the connector tube 18116 to engage the circumferentially spaced teeth 18060f of the tubular lower stop 18060,

torsional loads may be transmitted through the tension actuator assembly 18.

[00186] In an exemplary embodiment, as illustrated in Fig. 14A, the safety sub assembly 20 includes a tubular body 200a that defines a longitudinal passage 200b and includes an external flange 200c and an internal annular recess 200d at one end, and external annular recesses, 200e, 200f, 200g, and 200h at another end. A sealing member 202 is positioned within the external annular recess 200h at the other end of the tubular body 200a.

[00187] In an exemplary embodiment, as illustrated in Figs. 14A, 14B and 14C, the sealing cup assembly 22 includes an upper tubular mandrel 2202 that defines a longitudinal passage 2202a and internally threaded radial mounting holes, 2202b and 2202c, and includes an internal annular recess 2202d at one end, an internal annular recess 2202e, an internal annular recess 2202f, an internal annular recess 2202g, and an internally threaded internal annular recess 2202h and an external flange 2202i at another end. The internal annular recesses, 2202d, 2202e, and 2202f, of the upper tubular mandrel 2202 of the sealing cup assembly 22 receive, mate with, and are coupled to the other end of the tubular body 200a of the safety sub assembly 20.

[00188] An externally threaded end of a lower tubular mandrel 2204 that defines a longitudinal passage 2204a and includes an external annular recess 2204b at one end, an external annular recess 2204c, an external flange 2204d, an external annular recess 2204e, an externally threaded external flange 2204f, and an external annular recess 2204g at another end mates with, is received within, and is coupled to the internal annular recesses, 2202g and 2202h, of the other end of the upper tubular mandrel 2202.

[00189] Mounting screws, 2250a and 2205b, are received within and coupled to the mounting holes, 2202c and 2202b, respectively, of the tubular mandrel 2202 that extend into and engage the external annular recess 2204c of the lower tubular mandrel 2204.

[00190] A tubular cup seal spacer 2206 receives and is mounted upon the lower tubular mandrel 2204 proximate the external flange 2202i of the upper tubular mandrel 2202. A tubular cup seal retainer 2208 that includes an internal flange 2208a at one end receives and is mounted upon the lower tubular mandrel 2204 proximate the tubular cup seal spacer 2206. A tubular cup seal retainer 2210 that includes an internal flange 2210a at one end receives and is mounted upon the lower tubular mandrel 2204 proximate the other end of the tubular cup seal retainer 2208. In an exemplary embodiment, the tubular cup seal retainer 2210 is nested within the other end of the tubular cup seal retainer 2208. A tubular cup seal 2212 that includes an internal flange 2212a at one end receives and is mounted upon the lower tubular mandrel 2204 proximate the other end of the tubular cup seal retainer 2210. In an exemplary embodiment, the tubular cup seal 2212 is nested within the other end of the tubular cup seal retainer 2210.

[00191] A sealing member 2211 is received within the external annular recess 2204b of the lower tubular mandrel 2204 for sealing the interface between the lower tubular mandrel and the upper tubular mandrel 2202.

[00192] A tubular spacer 2214 receives and is mounted upon the lower tubular mandrel 2204 proximate the other end of the tubular cup seal 2212.

[00193] A tubular cup seal spacer 2216 receives and is mounted upon the lower tubular mandrel 2204 proximate the other end of the tubular spacer 2214. A tubular cup seal retainer 2218 that includes an internal flange 2218a at one end receives and is mounted upon the lower tubular mandrel 2204 proximate the other end of the tubular cup seal spacer 2216. A tubular cup seal retainer 2220 that includes an internal flange 2220a at one end receives and is mounted upon the lower tubular mandrel 2204 proximate the other end of the tubular cup seal retainer 2218. In an exemplary embodiment, the tubular cup seal retainer 2220 is nested within the other end of the tubular cup seal retainer 2218. A tubular cup seal 2222 that includes an internal flange 2222a at one end receives and is mounted upon the lower tubular mandrel 2204 proximate the other end of the tubular cup seal retainer 2220. In an exemplary embodiment, the tubular cup seal 2222 is nested within the other end of the tubular cup seal retainer 2220.

[00194] A tubular spacer 2224 receives and is mounted upon the lower tubular mandrel 2204 proximate the other end of the tubular cup seal 2222 at one end and proximate the external flange 2204d of the lower tubular mandrel at another end. A retaining ring 2226 receives and is mounted upon the other end of the tubular spacer 2224 proximate the external flange 2204d of the lower tubular mandrel 2204.

[00195] In an exemplary embodiment, during operation of the system 10, the end of the tubular body 200a of the safety sub assembly 20 is coupled to and receives and is coupled to an end of the tension actuator assembly 18 and the other end of the lower tubular mandrel 2204 of the sealing cup assembly 22 is received within and is coupled to an end of the casing lock assembly 24.

[00196] In an exemplary embodiment, during operation of the system 10, the tubular cup seals, 2212 and/or 2222, sealingly engage the interior surface of the expandable tubular member 100. In this manner, when an annulus defined between the system 10 and the expandable wellbore casing 10, below the tubular cup seals, 2212 and/or 2222, is pressurized, the resulting pressure differential across the tubular cup seals applies an upward tensile force to the system thereby pulling the adjustable bell section expansion cone assembly 28 and/or the adjustable casing expansion cone assembly 30 through the expandable wellbore casing. In this manner, the adjustable bell section expansion cone assembly 28 and/or the adjustable casing expansion cone assembly 30, if either or both are adjusted to an outside diameter suitable for a radial expansion operation, may radially

expand and plastically deform the expandable wellbore casing 100.

[00197] In an exemplary embodiment, the sealing cup assembly 22 operates and is provided substantially, at least in part, as disclosed in one or more of the following: (1) PCT patent application serial number PCT/US02/36157, attorney docket number 25791.87.02, filed on 11/12/2002, (2) PCT patent application serial number PCT/US02/36267, attorney docket number 25791.88.02, filed on 11/12/2002, (3) PCT patent application serial number PCT/US03/04837, attorney docket number 25791.95.02, filed on 2/29/2003, (4) PCT patent application serial number PCT/US03/29859, attorney docket no. 25791.102.02, filed on 9/22/2003, (5) PCT patent application serial number PCT/US03/14153, attorney docket number 25791.104.02, filed on 11/13/2003, (6) PCT patent application serial number PCT/US03/18530, attorney docket number 25791.108.02, filed on 6/11/2003, and/or (7) PCT patent application serial number PCT/US04/_____, attorney docket number 25791.253.02, filed on 3/11/2004, and/or (8) PCT patent application serial number PCT/US04/_____, attorney docket number 25791.260, filed on 3/26/2004, the disclosures of which are incorporated herein by reference.

[00198] In an exemplary embodiment, the casing lock assembly 24 operates and is provided substantially, at least in part, as disclosed in one or more of the following: (1) PCT patent application serial number PCT/US02/36267, attorney docket number 25791.88.02, filed on 11/12/2002, (2) PCT patent application serial number PCT/US03/29859, attorney docket no. 25791.102.02, filed on 9/22/2003, (3) PCT patent application serial number PCT/US03/14153, attorney docket number 25791.104.02, filed on 11/13/2003, and/or (4) PCT patent application serial number PCT/US04/_____, attorney docket number 25791.253.02, filed on 3/11/2004, and/or (5) PCT patent application serial number PCT/US04/_____, attorney docket number 25791.260, filed on 3/26/2004, the disclosures of which are incorporated herein by reference.

[00199] In an exemplary embodiment, the extension actuator assembly 26 operates and is provided substantially, at least in part, as disclosed in one or more of the following: (1) PCT patent application serial number PCT/US02/36267, attorney docket number 25791.88.02, filed on 11/12/2002, and/or (2) PCT patent application serial number PCT/US03/29859, attorney docket no. 25791.102.02, filed on 9/22/2003, and/or (3) PCT patent application serial number PCT/US__/_____, attorney docket number 25791.107.02, filed on _____, and/or (4) PCT patent application serial number PCT/US__/_____, attorney docket number 25791.114.02, filed on _____, and/or (5) PCT patent application serial number PCT/US04/_____, attorney docket number 25791.253.02, filed on 3/11/2004, and/or (6) PCT patent application serial number PCT/US04/_____, attorney docket number 25791.260, filed on 3/26/2004, the disclosures of which are incorporated herein by reference.

[00200] In an exemplary embodiment, the adjustable bell section expansion cone assembly 28 operates and is provided substantially, at least in part, as disclosed in one or more of the following: (1) PCT patent application serial number PCT/US02/36157, attorney docket number 25791.87.02, filed on 11/12/02, (2) PCT patent application serial number PCT/US02/36267, attorney docket number 25791.88.02, filed on 11/12/2002, (3) PCT patent application serial number PCT/US03/04837, attorney docket number 25791.95.02, filed on 2/29/03, (4) PCT patent application serial number PCT/US03/29859, attorney docket no. 25791.102.02, filed on 9/22/2003, (5) PCT patent application serial number PCT/US03/14153, attorney docket number 25791.104.02, filed on 11/13/2003, (6) PCT patent application serial number PCT/US03/18530, attorney docket number 25791.108.02, filed on 6/11/2003, and/or (7) PCT patent application serial number PCT/US04/_____, attorney docket number 25791.253.02, filed on 3/11/2004, and/or (8) PCT patent application serial number PCT/US04/_____, attorney docket number 25791.260, filed on 3/26/2004, the disclosures of which are incorporated herein by reference.

[00201] In an exemplary embodiment, as illustrated in Figs. 15-1 and 15-2, 15A1 to 15A2, 15B1 to 15B2, 15C, 15D, 15E, 15F, 15G, 15H, 15I, 15j, 15K, 15L, 15M, 15N, 15O, 15P, 15R, 15S, 15T, 15U, 15V, 15W, 15X, 15Y, 15Z1 to 15Z4, 15AA1 to 15AA4, 15AB1 to 15AB4, 15AC1 to 15AC4, 15AD, and 15AE, the adjustable bell section expansion cone assembly 28 includes an upper tubular tool joint 28002 that defines a longitudinal passage 28002a and mounting holes, 28002b and 28002c, and includes an internal threaded connection 28002d, an inner annular recess 28002e, an inner annular recess 28002f, and an internal threaded connection 28002g. A tubular torque plate 28004 that defines a longitudinal passage 28004a and includes circumferentially spaced apart teeth 28004b is received within, mates with, and is coupled to the internal annular recess 28002e of the upper tubular tool joint 28002.

[00202] Circumferentially spaced apart teeth 28006a of an end of a tubular lower mandrel 28006 that defines a longitudinal passage 28006b, a radial passage 28006ba, and a radial passage 28006bb and includes an external threaded connection 28006c, an external flange 28006d, an external annular recess 28006e having a step 28006f at one end, an external annular recess 28006g, external teeth 28006h, an external threaded connection 28006i, and an external annular recess 28006j engage the circumferentially spaced apart teeth 28004b of the tubular torque plate 28004. An internal threaded connection 28008a of an end of a tubular toggle bushing 28008 that defines a longitudinal passage 28008b, an upper longitudinal slot 28008c , a lower longitudinal slot 28008d, mounting holes, 28008e, 28008f, 28008g, 28008h, 28008i, 28008j, 28008k, 28008l, 28008m, 28008n, 28008o, 28008p, 28008q, 28008r, 28008s, 28008t, 28008u, 28008v, 28008w, 28008x, 28008xa, and 28008xb, and includes an external annular recess 28008y, internal annular recess 28008z,

external annular recess 28008aa, and an external annular recess 28008ab receives and is coupled to the external threaded connection 28006c of the tubular lower mandrel 28006.

[00203] A sealing element 28010 is received within the external annular recess 28008y of the tubular toggle bushing 28008 for sealing the interface between the tubular toggle bushing and the upper tubular tool joint 28002. A sealing element 28012 is received within the internal annular recess 28008z of the tubular toggle bushing 28008 for sealing the interface between the tubular toggle bushing and the tubular lower mandrel 28006.

[00204] Mounting screws, 28014a and 28014b, mounted within and coupled to the mounting holes, 28008w and 28008x, respectively, of the tubular toggle bushing 28008 are also received within the mounting holes, 28002b and 28002c, of the upper tubular tool joint 28002. Mounting pins, 28016a, 28016b, 28016c, 28016d, and 28016e, are mounted within the mounting holes, 28008e, 28008f, 28008g, 28008h, and 28008i, respectively. Mounting pins, 28018a, 28018b, 28018c, 28018d, and 28018e, are mounted within the mounting holes, 28008t, 28008s, 28008r, 28008q, and 28008p, respectively. Mounting screws, 28020a and 28020b, are mounted within the mounting holes, 28008u and 28008v, respectively.

[00205] A first upper toggle link 28022 defines mounting holes, 28022a and 28022b, for receiving the mounting pins, 28016a and 28016b, and includes a mounting pin 28022c at one end. A first lower toggle link 28024 defines mounting holes, 28024a, 28024b, and 28024c, for receiving the mounting pins, 28022c, 28016c, and 28016d, respectively and includes an engagement arm 28024d. A first trigger 28026 defines a mounting hole 28026a for receiving the mounting pin 28016e and includes an engagement arm 28026b at one end, an engagement member 28026c, and an engagement arm 28026d at another end.

[00206] A second upper toggle link 28028 defines mounting holes, 28028a and 28028b, for receiving the mounting pins, 28018a and 28018b, and includes a mounting pin 28028c at one end. A second lower toggle link 28030 defines mounting holes, 28030a, 28030b, and 28030c, for receiving the mounting pins, 28028c, 28018c, and 28018d, respectively and includes an engagement arm 28030d. A second trigger 28032 defines a mounting hole 28032a for receiving the mounting pin 28018e and includes an engagement arm 28032b at one end, an engagement member 28032c, and an engagement arm 28032d at another end.

[00207] An end of a tubular spring housing 28034 that defines a longitudinal passage 28034a, mounting holes, 28034b and 28034c, and mounting holes, 28034ba and 28034ca, and includes an internal flange 28034d and an internal annular recess 28034e at one end, and an internal flange 28034f, an internal annular recess 28034g, an internal annular recess 28034h, and an external threaded connection 28034i at another end receives and mates with the end of the tubular toggle bushing 28008. Mounting screws, 28035a and 28035b,

are mounted within and coupled to the mounting holes, 28008xb and 28008xa, respectively, of the tubular toggle bushing 28008 and are received within the mounting holes, 28034ba and 28034ca, respectively, of the tubular spring housing 28034.

[00208] A tubular retracting spring ring 28036 that defines mounting holes, 28036a and 28036b, receives and mates with a portion of the tubular lower mandrel 28006 and is received within and mates with a portion of the tubular spring housing 28034. Mounting screws, 28038a and 28038b, are mounted within and coupled to the mounting holes, 28036a and 28036b, respectively, of the tubular retracting spring ring 28036 and extend into the mounting holes, 28034b and 28034c, respectively, of the tubular spring housing 28034.

[00209] Casing diameter sensor springs, 28040a and 28040b, are positioned within the longitudinal slots, 28008c and 2808d, respectively, of the tubular toggle bushing 28008 that engage the engagement members, 28026c and 28032c, and engagement arms,28026d and 28032d, of the first and second triggers, 28026 and 28032, respectively. An inner flange 28042a of an end of a tubular spring washer 28042 mates with and receives a portion of the tubular lower mandrel 28006 and an end face of the inner flange of the tubular spring washer is positioned proximate and end face of the external flange 28006d of the tubular lower mandrel. The tubular spring washer 28042 is further received within the longitudinal passage 28034a of the tubular spring housing 28034.

[00210] An end of a retracting spring 28044 that receives the tubular lower mandrel 28006 is positioned within the tubular spring washer 28042 in contact with the internal flange 28042a of the tubular spring washer and the other end of the retracting spring is positioned in contact with an end face of the tubular retracting spring ring 28036.

[00211] A sealing element 28046 is received within the external annular recess 28006j of the tubular lower mandrel 28006 for sealing the interface between the tubular lower mandrel and the tubular spring housing 28034. A sealing element 28048 is received within the internal annular recess 28034h of the tubular spring housing 28034 for sealing the interface between the tubular spring housing and the tubular lower mandrel 28006.

[00212] An internal threaded connection 28050a of an end of a tubular upper hinge sleeve 28050 that includes an internal flange 28050b and an internal pivot 28050c receives and is coupled to the external threaded connection 28034i of the end of the tubular spring housing 28034.

[00213] An external flange 28052a of a base member 28052b of an upper cam assembly 28052, that is mounted upon and receives the lower tubular mandrel 28006, that includes an internal flange 28052c that is received within the external annular recess 28006e of the lower tubular mandrel 28006 and a plurality of circumferentially spaced apart tapered cam arms 28052d extending from the base member mates with and is received within the tubular upper hinge sleeve 28050. The base member 28052b of the upper cam assembly

28052 further includes a plurality of circumferentially spaced apart teeth 28052f that mate with and are received within a plurality of circumferentially spaced apart teeth 28034j provided on the end face of the tubular spring housing 28034 and an end face of the external flange 28052a of the base member of the upper cam assembly is positioned in opposing relation to an end face of the internal flange 28050b of the tubular upper hinge sleeve 28050. Each of the cam arms 28052d of the upper cam assembly 28052 include external cam surfaces 28052e. In an exemplary embodiment, the teeth 28052f of the base member 28052b of the upper cam assembly 28052 and the teeth 28034j provided on the end face of the tubular spring housing 28034 permit torsional loads to be transmitted between the tubular spring housing and the upper cam assembly.

[00214] A plurality of circumferentially spaced apart upper expansion segments 28054 are mounted upon and receive the lower tubular mandrel 28006 and each include an external pivot recess 28054a at one end for mating with and receiving the internal pivot 28050c of the tubular upper hinge sleeve 28050 and an external tapered expansion surface 28054b at another end and are pivotally mounted within the tubular upper hinge sleeve and are interleaved with the circumferentially spaced apart cam arms 28052d of the upper cam assembly 28052. The upper expansion segments 28054 are interleaved among the cam arms 28052d of the upper cam assembly 28052.

[00215] A plurality of circumferentially spaced apart lower expansion segments 28058 are mounted upon and receive the lower tubular mandrel 28006, are interleaved among the upper expansion segments 28054, are oriented in the opposite direction to the upper expansion segments 28054, each include an external pivot recess 28058a at one end and an external tapered expansion surface 28054b at another end and are positioned in opposing relation to corresponding circumferentially spaced apart cam arms 28052d of the upper cam assembly 28052.

[00216] A lower cam assembly 28060 is mounted upon and receives the lower tubular mandrel 28006 that includes a base member 28060a having an external flange 28060b, a plurality of circumferentially spaced apart cam arms 28060d that extend from the base member that each include external cam surfaces 28060e and define mounting holes 28060f and 28060g. The base member 28060a of the lower cam assembly 28060 further includes a plurality of circumferentially spaced apart teeth 28060h. The circumferentially spaced apart cam arms 28060d of the lower cam assembly 28060 are interleaved among the lower expansion segments 28058 and the circumferentially spaced apart cam arms 28052d of the upper cam assembly 28052 and positioned in opposing relation to corresponding upper expansion segments 28054.

[00217] Mounting screws, 28062a, 28062b, 28062c, and 28062e, are mounted within the corresponding mounting holes, 28060f and 28060g, of the lower cam assembly 28060

and are received within the external annular recess 28006g of the lower cam assembly 28060.

[00218] A tubular lower hinge sleeve 28064 that receives the lower expansion segments 28058 and the lower cam assembly 28060 includes an internal flange 28064a for engaging the external flange 28060b of the base member of the lower cam assembly 28060, an internal pivot 28064b for engaging and receiving the external pivot recess 28058a of the lower expansion segments 28058 thereby pivotally mounting the lower expansion segments within the tubular lower hinge sleeve, and an internal threaded connection 28064c.

[00219] An external threaded connection 28066a of an end of a tubular sleeve 28066 that defines mounting holes, 28066b and 28066c, and includes an internal annular recess 28066d having a shoulder 28066e, an internal flange 28066f, and an internal threaded connection 28066g at another end is received within and coupled to the internal threaded connection 28064c of the tubular lower hinge sleeve 28064. An external threaded connection 28068a of an end of a tubular member 28068 that defines a longitudinal passage 28068b and mounting holes, 28068c and 28068d, and includes an external annular recess 28068e, and an external threaded connection 28068f at another end is received within and is coupled to the internal threaded connection 28066g of the tubular sleeve 28066.

[00220] Mounting screws, 28070a and 28070b, are mounted in and coupled to the mounting holes, 28068c and 28068d, respectively, of the tubular member 28068 that also extend into the mounting holes, 28066b and 28066c, respectively, of the tubular sleeve 28066. A sealing element 28072 is received within the external annular recess 28068e of the tubular member 28068 for sealing the interface between the tubular member and the tubular sleeve 28066.

[00221] An internal threaded connection 28074a of a tubular retracting piston 28074 that defines a longitudinal passage 28074b and includes an internal annular recess 28074c and an external annular recess 28074d receives and is coupled to the external threaded connection 28006i of the tubular lower mandrel 28006. A sealing element 28076 is received within the external annular recess 28074d of the tubular retracting piston 28074 for sealing the interface between the tubular retracting piston and the tubular sleeve 28066. A sealing element 28078 is received within the internal annular recess 28074c of the tubular retracting piston 28074 for sealing the interface between the tubular retracting piston and the tubular lower mandrel 28006.

[00222] Locking dogs 28080 mate with and receive the external teeth 28006h of the tubular lower mandrel 28006. A spacer ring 28082 is positioned between an end face of the locking dogs 28080 and an end face of the lower cam assembly 28060. A release piston 28084 mounted upon the tubular lower mandrel 28006 defines a radial passage 28084a for mounting a burst disk 28086 includes sealing elements, 28084b, 28084c, and 28084d. The

sealing elements, 28084b and 28084d, sealing the interface between the release piston 28084 and the tubular lower mandrel 28006. An end face of the release piston 28084 is positioned in opposing relation to an end face of the locking dogs 28080.

[00223] A release sleeve 28088 that receives and is mounted upon the locking dogs 28080 and the release piston 28084 includes an internal flange 28088a at one end that sealingly engages the tubular lower mandrel 28006. A bypass sleeve 28090 that receives and is mounted upon the release sleeve 28088 includes an internal flange 28090a at one end.

[00224] In an exemplary embodiment, during operation of the adjustable bell section expansion cone assembly 28, the retracting spring 28044 is compressed and thereby applies a biasing spring force in a direction 28092 from the lower tubular mandrel 28006 to the tubular spring housing 28034 that, in the absence of other forces, moves and/or maintains the upper cam assembly 28052 and the upper expansion segments 28054 out of engagement with the lower expansion segments 28058 and the lower cam assembly 28060. In an exemplary embodiment, during operation of the adjustable bell section expansion cone assembly 28, an external threaded connection 20a of an end of the sealing cup assembly 20 is coupled to the internal threaded connection 28002d of the upper tubular tool joint 28002 and an internal threaded connection 30a of an end of the adjustable casing expansion cone assembly 30 is coupled to the external threaded connection 28068f of the tubular member 28068.

[00225] The upper cam assembly 28052 and the upper expansion segments 28054 may be brought into engagement with the lower expansion segments 28058 and the lower cam assembly 28060 by pressurizing an annulus 28094 defined between the lower tubular mandrel 28006 and the tubular spring housing 28034. In particular, injection of fluidic materials into the adjustable bell section expansion cone assembly 28 through the longitudinal passage 28006b of the lower tubular mandrel 28006 and into the radial passage 28006ba may pressurize the annulus 28094 thereby creating sufficient operating pressure to generate a force in a direction 28096 sufficient to overcome the biasing force of the retracting spring 28044. As a result, the spring housing 28034 may be displaced in the direction 28096 relative to the lower tubular mandrel 28006 thereby displacing the tubular upper hinge sleeve 28050, upper cam assembly 28052 , and upper expansion segments 28054 in the direction 28096.

[00226] In an exemplary embodiment, as illustrated in Figs. 15P and 15R, the displacement of the upper cam assembly 28052 and upper expansion segments 28054 in the direction 28096 will cause the lower expansion segments 28058 to ride up the cam surfaces 28052e of the cam arms 28052d of the upper cam assembly 28052 while also pivoting about the lower tubular hinge segment 28064, and will also cause the upper

expansion segments 28054 to ride up the cam surfaces 28060e of the cam arms 28060d of the lower cam assembly 28060 while also pivoting about the upper tubular hinge segment 28050. In an exemplary embodiment, when the upper and lower expansion segments, 28054 and 28058, are brought into axial alignment, they define an outer expansion surface that is approximately contiguous in a circumferential direction and which provides an outer expansion surface that at least approximates a conical surface.

[00227] In an exemplary embodiment, during the operation of the adjustable bell section expansion cone assembly 28, when the upper and lower expansion segments, 28054 and 28058, brought into axial alignment into a radially expanded position, the upper and lower expansion segments, 28054 and 28058, are displaced relative to the expandable wellbore casing 100 to thereby radially expand and plastically deform at least a portion of the expandable wellbore casing. In an exemplary embodiment, during the radial expansion and plastic deformation of the expandable wellbore casing 100, the adjustable bell section expansion cone assembly 28 may then be rotated relative to the expandable wellbore casing to enhance and/or modify the rate at which the expandable wellbore casing is radially expanded and plastically deformed.

[00228] In an exemplary embodiment, the upper cam assembly 28052 and the upper expansion segments 28054 may be moved out of engagement with the lower expansion segments 28058 and the lower cam assembly 28060 by reducing the operating pressure within the annulus 28094.

[00229] In an alternative embodiment, as illustrated in Figs. 15S, 15T, 15U and 15V, during operation of the adjustable bell section expansion cone assembly 28, the upper cam assembly 28052 and the upper expansion segments 28054 may also be moved out of engagement with the lower expansion segments 28058 and the lower cam assembly 28060 by sensing the operating pressure within the longitudinal passage 28006b of the lower tubular mandrel 28006. In particular, as illustrated in Fig. 15T, if the operating pressure within the longitudinal passage 28006b and radial passage 28006bb of the lower tubular mandrel 28006 exceeds a predetermined value, the burst disc 28086 will open the passage 28084a thereby pressurizing the interior of the tubular release sleeve 28088 thereby displacing the tubular release sleeve 28088 downwardly in a direction 28092 away from engagement with the locking dogs 28080.

[00230] As a result, as illustrated in Fig. 15U, the locking dogs 28080 are displaced outwardly in the radial directed and thereby released from engagement with the lower tubular mandrel 28006 thereby permitting the lower expansion segments 28058 and the lower cam assembly 28060 to be displaced downwardly relative to the lower tubular mandrel.

[00231] As a result, as illustrated in Fig. 15V, the operating pressure within the lower

tubular mandrel 28066 may then cause the lower tubular mandrel to be displaced downwardly in the direction 28094 relative to the tubular lower mandrel 28006 and the retracting piston 28074. As a result, the lower tubular mandrel 28066, the lower expansion segments 28058, the lower cam assembly 28060, and tubular lower hinge sleeve 28064 are displaced downwardly in the direction 28094 relative to the tubular spring housing 28034 thereby moving the lower expansion segments 28058 and the lower cam assembly 28060 out of engagement with the upper cam assembly 28052 and the upper expansion segments 28054.

[00232] In an exemplary embodiment, as illustrated in Figs. 15W, 15X, and 15Y, during operation of the adjustable bell section expansion cone assembly 28, the adjustable bell section expansion cone assembly senses the diameter of the expandable wellbore casing 100 using the upper toggle links, 28022 and 28028, lower toggle links, 28024 and 28030, and triggers, 28026 and 28032, and then prevents the engagement of the upper cam assembly 28052 and the upper expansion segments 28054 with the lower expansion segments 28058 and the lower cam assembly 28060.

[00233] In particular, as illustrated in Fig. 15W, anytime the upper toggle links, 28022 and 28028, and lower toggle links, 28024 and 28030, are positioned within a portion of the expandable wellbore casing 100 that has been radially expanded and plastically deformed by the system 10, the triggers, 28026 and 28032, will be pivoted by the engagement arms, 28024d and 28030d, of the lower toggle links, 28024 and 28030, to a position in which the triggers will no longer engage the internal flange 28034d of the end of the tubular spring housing 28034 thereby permitting the displacement of the tubular spring housing in the direction 28096. As a result, the upper cam assembly 28052 and the upper expansion segments 28054 can be brought into engagement with the lower expansion segments 28058 and the lower cam assembly 28060. In an exemplary embodiment, the upper toggle links, 28022 and 28028, and the lower toggle links, 28024 and 28030, are spring biased towards the position illustrated in Fig. 15W.

[00234] Conversely, as illustrated in Fig. 15X, anytime the upper toggle links, 28022 and 28028, and lower toggle links, 28024 and 28030, are positioned within a portion of the expandable wellbore casing 100 that has not been radially expanded and plastically deformed by the system 10, the triggers, 28026 and 28032, will be maintained in a position in which the triggers will engage the internal flange 28034d of the end of the tubular spring housing 28034 thereby preventing the displacement of the tubular spring housing in the direction 28096. As a result, the upper cam assembly 28052 and the upper expansion segments 28054 cannot be brought into engagement with the lower expansion segments 28058 and the lower cam assembly 28060. In an exemplary embodiment, the triggers, 28026 and 28032, are spring biased towards the position illustrated in Fig. 15X.

[00235] In an exemplary embodiment, as illustrated in Fig. 15Y, the tubular spring housing 28034 may be displaced upwardly in the direction 28098 even if the upper toggle links, 28022 and 28028, and lower toggle links, 28024 and 28030, are positioned within a portion of the expandable wellbore casing 100 that has not been radially expanded and plastically deformed by the system 10.

[00236] In an exemplary embodiment, as illustrated in Figs. 15Z1 to 15Z4, 15AA1 to 15AA4, 15AB1 to 15AB4, 15AC1 to 15AC4, 15AD, and 15AE, the tubular spring housing 28034 of the adjustable bell section expansion cone assembly 28 defines internal annular recesses 28034k and 28034l, spaced apart by an internal flange 28034m, the tubular toggle bushing 28008 defines an external annular recess 28008ac, and the adjustable bell section expansion cone assembly further includes pins, 28100a and 28100b and 28102a and 28102b, mounted in holes 28008j and 28008o and 28008k and 28008n, respectively, of the tubular toggle bushing, and a one-shot deactivation device 28104 mounted on the tubular toggle bushing between the pins, 28100a and 28100b and 28102a and 28102b.

[00237] The one-shot deactivation device 28104 includes a tubular body 28104a that defines radial holes, 28104b and 28014c, and includes an external annular recess 28104d at one end, a centrally positioned external flange 28104e, a centrally positioned internal annular recess 28104f, and an external annular recess 28104g at another end. An engagement member 28106 that includes a base member 28106a having a tapered end 28106b and a key member 28106c having a tapered end 28106d is received within a portion of the internal annular recess 28104f of the tubular body 28104a and an engagement member 28108 that includes a base member 28108a having a tapered end 28108b and a key member 28108c having a tapered end 28108d is received within an opposite portion of the internal annular recess 28104f of the tubular body 28104a. Spring members, 28110 and 28112, are received within the annular recess 28104f of the tubular body 28104a for biasing the base members, base member 28106a and 28108a, of the engagement members, 28106 and 28108, respectively, radially inwardly relative to the tubular body 28104a.

[00238] In an exemplary embodiment, during operation of the adjustable bell section expansion cone assembly 28, as illustrated in Figs. 15Z1 to 15Z4, the one-shot deactivation device 28104 are positioned proximate and in intimate contact with the pins, 28102a and 28102b, with the tapered ends, 28106b and 28108b, of the base members, 28106a and 28108a, of the engagement members, 28106 and 28108, received within the external annular recess 28008ac of the tubular toggle bushing 28008. When the one-shot deactivation device 28104 is positioned as illustrated in Figs. 15Z1 to 15Z4, the external annular recess 28104d of the tubular body 28104a of the one-shot deactivation device is moved out of engagement with the engagement arms, 28026d and 28032d, of the triggers, 28026 and 28032, respectively. As a result, the triggers, 28026 and 28032, may operate

normally as described above with reference to Figs. 15W, 15X, and 15Y.

[00239] Conversely, in an exemplary embodiment, during operation of the adjustable bell section expansion cone assembly 28, as illustrated in Figs. 15AA1 to 15AA4, the one-shot deactivation device 28104 are positioned proximate and in intimate contact with the pins, 28100a and 28100b, with the tapered ends, 28106b and 28108b, of the base members, 28106a and 28108a, of the engagement members, 28106 and 28108, not received within the external annular recess 28008ac of the tubular toggle bushing 28008. When the one-shot deactivation device 28104 is positioned as illustrated in Fig. 15AA, the external annular recess 28104d of the tubular body 28104a of the one-shot deactivation device is moved into engagement with the engagement arms, 28026d and 28032d, of the triggers, 28026 and 28032, respectively. As a result, the triggers, 28026 and 28032, are deactivated and may not operate normally as described above with reference to Figs. 15W, 15X, and 15Y.

[00240] In an alternative embodiment, the elements of the adjustable bell section expansion cone assembly 28 that sense the diameter of the expandable wellbore casing 100 may be disabled or omitted or adjusted to sense any pre-selected internal diameter of the expandable wellbore casing.

[00241] In an exemplary embodiment, the adjustable casing expansion cone assembly 30 operates and is provided substantially, at least in part, as disclosed in one or more of the following: (1) PCT patent application serial number PCT/US02/36157, attorney docket number 25791.87.02, filed on 11/12/02, (2) PCT patent application serial number PCT/US02/36267, attorney docket number 25791.88.02, filed on 11/12/2002, (3) PCT patent application serial number PCT/US03/04837, attorney docket number 25791.95.02, filed on 2/29/03, (4) PCT patent application serial number PCT/US03/29859, attorney docket no. 25791.102.02, filed on 9/22/2003, (5) PCT patent application serial number PCT/US03/14153, attorney docket number 25791.104.02, filed on 11/13/2003, (6) PCT patent application serial number PCT/US03/18530, attorney docket number 25791.108.02, filed on 6/11/2003, and/or (7) PCT patent application serial number PCT/US04/_____, attorney docket number 25791.253.02, filed on 3/11/2004, and/or (8) PCT patent application serial number PCT/US04/_____, attorney docket number 25791.260, filed on 3/26/2004, the disclosures of which are incorporated herein by reference.

[00242] In an exemplary embodiment, as illustrated in Figs. 16-1 and 16-2, 16A1 to 16A2, 16B1 to 16B2, 16C, 16D, 16E, 16F, 16G, 16H, 16I, 16j, 16K, 16L, 16M, 16N, 16O, 16P, 16R, 16S, 16T, 16U, 16V, 16W, 16X, 16Y, 16Z1-16Z4, 16AA1 to 16AA4, 16AB1 to 16AB4, 16AC1 to 16AC4, 16AD, and 16AE, the adjustable casing expansion cone assembly 30 includes an upper tubular tool joint 30002 that defines a longitudinal passage 30002a and mounting holes, 30002b and 30002c, and includes an internal threaded connection 30002d,

an inner annular recess 30002e, an inner annular recess 30002f, and an internal threaded connection 30002g. A tubular torque plate 30004 that defines a longitudinal passage 30004a and includes circumferentially spaced apart teeth 30004b is received within, mates with, and is coupled to the internal annular recess 30002e of the upper tubular tool joint 30002.

[00243] Circumferentially spaced apart teeth 30006a of an end of a tubular lower mandrel 30006 that defines a longitudinal passage 30006b, a radial passage 30006ba, and a radial passage 30006bb and includes an external threaded connection 30006c, an external flange 30006d, an external annular recess 30006e having a step 30006f at one end, an external annular recess 30006g, external teeth 30006h, an external threaded connection 30006i, and an external annular recess 30006j engage the circumferentially spaced apart teeth 30004b of the tubular torque plate 30004. An internal threaded connection 30008a of an end of a tubular toggle bushing 30008 that defines a longitudinal passage 30008b, an upper longitudinal slot 30008c , a lower longitudinal slot 30008d, mounting holes, 30008e, 30008f, 30008g, 30008h, 30008i, 30008j, 30008k, 30008l, 30008m, 30008n, 30008o, 30008p, 30008q, 30008r, 30008s, 30008t, 30008u, 30008v, 30008w, 30008x, 30008xa, and 30008xb, and includes an external annular recess 30008y, internal annular recess 30008z, external annular recess 30008aa, and an external annular recess 30008ab receives and is coupled to the external threaded connection 30006c of the tubular lower mandrel 30006.

[00244] A sealing element 30010 is received within the external annular recess 30008y of the tubular toggle bushing 30008 for sealing the interface between the tubular toggle bushing and the upper tubular tool joint 30002. A sealing element 30012 is received within the internal annular recess 30008z of the tubular toggle bushing 30008 for sealing the interface between the tubular toggle bushing and the tubular lower mandrel 30006.

[00245] Mounting screws, 30014a and 30014b, mounted within and coupled to the mounting holes, 30008w and 30008x, respectively, of the tubular toggle bushing 30008 are also received within the mounting holes, 30002b and 30002c, of the upper tubular tool joint 30002. Mounting pins, 30016a, 30016b, 30016c, 30016d, and 30016e, are mounted within the mounting holes, 30008e, 30008f, 30008g, 30008h, and 30008i, respectively. Mounting pins, 30018a, 30018b, 30018c, 30018d, and 30018e, are mounted within the mounting holes, 30008t, 30008s, 30008r, 30008q, and 30008p, respectively. Mounting screws, 30020a and 30020b, are mounted within the mounting holes, 30008u and 30008v, respectively.

[00246] A first upper toggle link 30022 defines mounting holes, 30022a and 30022b, for receiving the mounting pins, 30016a and 30016b, and includes a mounting pin 30022c at one end. A first lower toggle link 30024 defines mounting holes, 30024a, 30024b, and 30024c, for receiving the mounting pins, 30022c, 30016c, and 30016d, respectively and

includes an engagement arm 30024d. A first trigger 30026 defines a mounting hole 30026a for receiving the mounting pin 30016e and includes an engagement arm 30026b at one end, an engagement member 30026c, and an engagement arm 30026d at another end.

[00247] A second upper toggle link 30028 defines mounting holes, 30028a and 30028b, for receiving the mounting pins, 30018a and 30018b, and includes a mounting pin 30028c at one end. A second lower toggle link 30030 defines mounting holes, 30030a, 30030b, and 30030c, for receiving the mounting pins, 30028c, 30018c, and 30018d, respectively and includes an engagement arm 30030d. A second trigger 30032 defines a mounting hole 30032a for receiving the mounting pin 30018e and includes an engagement arm 30032b at one end, an engagement member 30032c, and an engagement arm 30032d at another end.

[00248] An end of a tubular spring housing 30034 that defines a longitudinal passage 30034a, mounting holes, 30034b and 30034c, and mounting holes, 30034ba and 30034ca, and includes an internal flange 30034d and an internal annular recess 30034e at one end, and an internal flange 30034f, an internal annular recess 30034g, an internal annular recess 30034h, and an external threaded connection 30034i at another end receives and mates with the end of the tubular toggle bushing 30008. Mounting screws, 30035a and 30035b, are mounted within and coupled to the mounting holes, 30008xb and 30008xa, respectively, of the tubular toggle bushing 30008 and are received within the mounting holes, 30034ba and 30034ca, respectively, of the tubular spring housing 30034.

[00249] A tubular retracting spring ring 30036 that defines mounting holes, 30036a and 30036b, receives and mates with a portion of the tubular lower mandrel 30006 and is received within and mates with a portion of the tubular spring housing 30034. Mounting screws, 30038a and 30038b, are mounted within and coupled to the mounting holes, 30036a and 30036b, respectively, of the tubular retracting spring ring 30036 and extend into the mounting holes, 30034b and 30034c, respectively, of the tubular spring housing 30034.

[00250] Casing diameter sensor springs, 30040a and 30040b, are positioned within the longitudinal slots, 30008c and 3008d, respectively, of the tubular toggle bushing 30008 that engage the engagement members, 30026c and 30032c, and engagement arms,30026d and 30032d, of the first and second triggers, 30026 and 30032, respectively. An inner flange 30042a of an end of a tubular spring washer 30042 mates with and receives a portion of the tubular lower mandrel 30006 and an end face of the inner flange of the tubular spring washer is positioned proximate and end face of the external flange 30006d of the tubular lower mandrel. The tubular spring washer 30042 is further received within the longitudinal passage 30034a of the tubular spring housing 30034.

[00251] An end of a retracting spring 30044 that receives the tubular lower mandrel 30006 is positioned within the tubular spring washer 30042 in contact with the internal flange

30042a of the tubular spring washer and the other end of the retracting spring is positioned in contact with an end face of the tubular retracting spring ring 30036.

[00252] A sealing element 30046 is received within the external annular recess 30006j of the tubular lower mandrel 30006 for sealing the interface between the tubular lower mandrel and the tubular spring housing 30034. A sealing element 30048 is received within the internal annular recess 30034h of the tubular spring housing 30034 for sealing the interface between the tubular spring housing and the tubular lower mandrel 30006.

[00253] An internal threaded connection 30050a of an end of a tubular upper hinge sleeve 30050 that includes an internal flange 30050b and an internal pivot 30050c receives and is coupled to the external threaded connection 30034i of the end of the tubular spring housing 30034.

[00254] An external flange 30052a of a base member 30052b of an upper cam assembly 30052, that is mounted upon and receives the lower tubular mandrel 30006, that includes an internal flange 30052c that is received within the external annular recess 30006e of the lower tubular mandrel 30006 and a plurality of circumferentially spaced apart tapered cam arms 30052d extending from the base member mates with and is received within the tubular upper hinge sleeve 30050. The base member 30052b of the upper cam assembly 30052 further includes a plurality of circumferentially spaced apart teeth 30052f that mate with and are received within a plurality of circumferentially spaced apart teeth 30034j provided on the end face of the tubular spring housing 30034 and an end face of the external flange 30052a of the base member of the upper cam assembly is positioned in opposing relation to an end face of the internal flange 30050b of the tubular upper hinge sleeve 30050. Each of the cam arms 30052d of the upper cam assembly 30052 include external cam surfaces 30052e. In an exemplary embodiment, the teeth 30052f of the base member 30052b of the upper cam assembly 30052 and the teeth 30034j provided on the end face of the tubular spring housing 30034 permit torsional loads to be transmitted between the tubular spring housing and the upper cam assembly.

[00255] A plurality of circumferentially spaced apart upper expansion segments 30054 are mounted upon and receive the lower tubular mandrel 30006 and each include an external pivot recess 30054a at one end for mating with and receiving the internal pivot 30050c of the tubular upper hinge sleeve 30050 and an external tapered expansion surface 30054b at another end and are pivotally mounted within the tubular upper hinge sleeve and are interleaved with the circumferentially spaced apart cam arms 30052d of the upper cam assembly 30052. The upper expansion segments 30054 are interleaved among the cam arms 30052d of the upper cam assembly 30052.

[00256] A plurality of circumferentially spaced apart lower expansion segments 30058 are mounted upon and receive the lower tubular mandrel 30006, are interleaved among the

upper expansion segments 30054, are oriented in the opposite direction to the upper expansion segments 30054, each include an external pivot recess 30058a at one end and an external tapered expansion surface 30054b at another end and are positioned in opposing relation to corresponding circumferentially spaced apart cam arms 30052d of the upper cam assembly 30052.

[00257] A lower cam assembly 30060 is mounted upon and receives the lower tubular mandrel 30006 that includes a base member 30060a having an external flange 30060b, a plurality of circumferentially spaced apart cam arms 30060d that extend from the base member that each include external cam surfaces 30060e and define mounting holes 30060f and 30060g. The base member 30060a of the lower cam assembly 30060 further includes a plurality of circumferentially spaced apart teeth 30060h. The circumferentially spaced apart cam arms 30060d of the lower cam assembly 30060 are interleaved among the lower expansion segments 30058 and the circumferentially spaced apart cam arms 30052d of the upper cam assembly 30052 and positioned in opposing relation to corresponding upper expansion segments 30054.

[00258] Mounting screws, 30062a, 30062b, 30062c, and 30062e, are mounted within the corresponding mounting holes, 30060f and 30060g, of the lower cam assembly 30060 and are received within the external annular recess 30006g of the lower cam assembly 30060.

[00259] A tubular lower hinge sleeve 30064 that receives the lower expansion segments 30058 and the lower cam assembly 30060 includes an internal flange 30064a for engaging the external flange 30060b of the base member of the lower cam assembly 30060, an internal pivot 30064b for engaging and receiving the external pivot recess 30058a of the lower expansion segments 30058 thereby pivotally mounting the lower expansion segments within the tubular lower hinge sleeve, and an internal threaded connection 30064c.

[00260] An external threaded connection 30066a of an end of a tubular sleeve 30066 that defines mounting holes, 30066b and 30066c, and includes an internal annular recess 30066d having a shoulder 30066e, an internal flange 30066f, and an internal threaded connection 30066g at another end is received within and coupled to the internal threaded connection 30064c of the tubular lower hinge sleeve 30064. An external threaded connection 30068a of an end of a tubular member 30068 that defines a longitudinal passage 30068b and mounting holes, 30068c and 30068d, and includes an external annular recess 30068e, and an external threaded connection 30068f at another end is received within and is coupled to the internal threaded connection 30066g of the tubular sleeve 30066.

[00261] Mounting screws, 30070a and 30070b, are mounted in and coupled to the mounting holes, 30068c and 30068d, respectively, of the tubular member 30068 that also extend into the mounting holes, 30066b and 30066c, respectively, of the tubular sleeve

30066. A sealing element 30072 is received within the external annular recess 30068e of the tubular member 30068 for sealing the interface between the tubular member and the tubular sleeve 30066.

[00262] An internal threaded connection 30074a of a tubular retracting piston 30074 that defines a longitudinal passage 30074b and includes an internal annular recess 30074c and an external annular recess 30074d receives and is coupled to the external threaded connection 30006i of the tubular lower mandrel 30006. A sealing element 30076 is received within the external annular recess 30074d of the tubular retracting piston 30074 for sealing the interface between the tubular retracting piston and the tubular sleeve 30066. A sealing element 30078 is received within the internal annular recess 30074c of the tubular retracting piston 30074 for sealing the interface between the tubular retracting piston and the tubular lower mandrel 30006.

[00263] Locking dogs 30080 mate with and receive the external teeth 30006h of the tubular lower mandrel 30006. A spacer ring 30082 is positioned between an end face of the locking dogs 30080 and an end face of the lower cam assembly 30060. A release piston 30084 mounted upon the tubular lower mandrel 30006 defines a radial passage 30084a for mounting a burst disk 30086 includes sealing elements, 30084b, 30084c, and 30084d. The sealing elements, 30084b and 30084d, sealing the interface between the release piston 30084 and the tubular lower mandrel 30006. An end face of the release piston 30084 is positioned in opposing relation to an end face of the locking dogs 30080.

[00264] A release sleeve 30088 that receives and is mounted upon the locking dogs 30080 and the release piston 30084 includes an internal flange 30088a at one end that sealingly engages the tubular lower mandrel 30006. A bypass sleeve 30090 that receives and is mounted upon the release sleeve 30088 includes an internal flange 30090a at one end.

[00265] In an exemplary embodiment, during operation of the adjustable casing expansion cone assembly 30, the retracting spring 30044 is compressed and thereby applies a biasing spring force in a direction 30092 from the lower tubular mandrel 30006 to the tubular spring housing 30034 that, in the absence of other forces, moves and/or maintains the upper cam assembly 30052 and the upper expansion segments 30054 out of engagement with the lower expansion segments 30058 and the lower cam assembly 30060. In an exemplary embodiment, during operation of the adjustable bell section expansion cone assembly 28, an external threaded connection 20a of an end of the sealing cup assembly 20 is coupled to the internal threaded connection 30002d of the upper tubular tool joint 30002 and an internal threaded connection 30a of an end of the adjustable casing expansion cone assembly 30 is coupled to the external threaded connection 30068f of the tubular member 30068.

[00266] The upper cam assembly 30052 and the upper expansion segments 30054 may be brought into engagement with the lower expansion segments 30058 and the lower cam assembly 30060 by pressurizing an annulus 30094 defined between the lower tubular mandrel 30006 and the tubular spring housing 30034. In particular, injection of fluidic materials into the adjustable casing expansion cone assembly 30 through the longitudinal passage 30006b of the lower tubular mandrel 30006 and into the radial passage 30006ba may pressurize the annulus 30094 thereby creating sufficient operating pressure to generate a force in a direction 30096 sufficient to overcome the biasing force of the retracting spring 30044. As a result, the spring housing 30034 may be displaced in the direction 30096 relative to the lower tubular mandrel 30006 thereby displacing the tubular upper hinge sleeve 30050, upper cam assembly 30052 , and upper expansion segments 30054 in the direction 30096.

[00267] In an exemplary embodiment, as illustrated in Figs. 16P, 16Q, and 16R, the displacement of the upper cam assembly 30052 and upper expansion segments 30054 in the direction 30096 will cause the lower expansion segments 30058 to ride up the cam surfaces 30052e of the cam arms 30052d of the upper cam assembly 30052 while also pivoting about the lower tubular hinge segment 30064, and will also cause the upper expansion segments 30054 to ride up the cam surfaces 30060e of the cam arms 30060d of the lower cam assembly 30060 while also pivoting about the upper tubular hinge segment 30050. In an exemplary embodiment, when the upper and lower expansion segments, 30054 and 30058, are brought into axial alignment, they define an outer expansion surface that is approximately contiguous in a circumferential direction and which provides an outer expansion surface that at least approximates a conical surface.

[00268] In an exemplary embodiment, during the operation of the adjustable casing expansion cone assembly 30, when the upper and lower expansion segments, 30054 and 30058, brought into axial alignment into a radially expanded position, the upper and lower expansion segments, 30054 and 30058, are displaced relative to the expandable wellbore casing 100 to thereby radially expand and plastically deform at least a portion of the expandable wellbore casing. In an exemplary embodiment, during the radial expansion and plastic deformation of the expandable wellbore casing 100, the adjustable casing expansion cone assembly 30 may then be rotated relative to the expandable wellbore casing to enhance and/or modify the rate at which the expandable wellbore casing is radially expanded and plastically deformed.

[00269] In an exemplary embodiment, the upper cam assembly 30052 and the upper expansion segments 30054 may be moved out of engagement with the lower expansion segments 30058 and the lower cam assembly 30060 by reducing the operating pressure within the annulus 30094.

[00270] In an alternative embodiment, as illustrated in Figs. 16S, 16T, 16U and 16V, during operation of the adjustable casing expansion cone assembly 30, the upper cam assembly 30052 and the upper expansion segments 30054 may also be moved out of engagement with the lower expansion segments 30058 and the lower cam assembly 30060 by sensing the operating pressure within the longitudinal passage 30006b of the lower tubular mandrel 30006. In particular, as illustrated in Fig. 16T, if the operating pressure within the longitudinal passage 30006b and radial passage 30006bb of the lower tubular mandrel 30006 exceeds a predetermined value, the burst disc 30086 will open the passage 30084a thereby pressurizing the interior of the tubular release sleeve 30088 thereby displacing the tubular release sleeve 30088 downwardly in a direction 30092 away from engagement with the locking dogs 30080.

[00271] As a result, as illustrated in Fig. 16U, the locking dogs 30080 are displaced outwardly in the radial directed and thereby released from engagement with the lower tubular mandrel 30006 thereby permitting the lower expansion segments 30058 and the lower cam assembly 30060 to be displaced downwardly relative to the lower tubular mandrel.

[00272] As a result, as illustrated in Fig. 16V, the operating pressure within the lower tubular mandrel 30066 may then cause the lower tubular mandrel to be displaced downwardly in the direction 30094 relative to the tubular lower mandrel 30006 and the retracting piston 30074. As a result, the lower tubular mandrel 30066, the lower expansion segments 30058, the lower cam assembly 30060, and tubular lower hinge sleeve 30064 are displaced downwardly in the direction 30094 relative to the tubular spring housing 30034 thereby moving the lower expansion segments 30058 and the lower cam assembly 30060 out of engagement with the upper cam assembly 30052 and the upper expansion segments 30054.

[00273] In an exemplary embodiment, as illustrated in Figs. 16W, 16X, and 16Y, during operation of the adjustable casing expansion cone assembly 30, the adjustable casing expansion cone assembly senses the diameter of the expandable wellbore casing 100 using the upper toggle links, 30022 and 30028, lower toggle links, 30024 and 30030, and triggers, 30026 and 30032, and then prevents the engagement of the upper cam assembly 30052 and the upper expansion segments 30054 with the lower expansion segments 30058 and the lower cam assembly 30060.

[00274] In particular, as illustrated in Fig. 16W, anytime the upper toggle links, 30022 and 30028, and lower toggle links, 30024 and 30030, are positioned within a portion of the expandable wellbore casing 100 that has been radially expanded and plastically deformed by the system 10, the triggers, 30026 and 30032, will be pivoted by the engagement arms, 30024d and 30030d, of the lower toggle links, 30024 and 30030, to a position in which the

triggers will no longer engage the internal flange 30034d of the end of the tubular spring housing 30034 thereby permitting the displacement of the tubular spring housing in the direction 30096. As a result, the upper cam assembly 30052 and the upper expansion segments 30054 can be brought into engagement with the lower expansion segments 30058 and the lower cam assembly 30060. In an exemplary embodiment, the upper toggle links, 30022 and 30028, and the lower toggle links, 30024 and 30030, are spring biased towards the position illustrated in Fig. 16W.

[00275] Conversely, as illustrated in Fig. 16X, anytime the upper toggle links, 30022 and 30028, and lower toggle links, 30024 and 30030, are positioned within a portion of the expandable wellbore casing 100 that has not been radially expanded and plastically deformed by the system 10, the triggers, 30026 and 30032, will be maintained in a position in which the triggers will engage the internal flange 30034d of the end of the tubular spring housing 30034 thereby preventing the displacement of the tubular spring housing in the direction 30096. As a result, the upper cam assembly 30052 and the upper expansion segments 30054 cannot be brought into engagement with the lower expansion segments 30058 and the lower cam assembly 30060. In an exemplary embodiment, the triggers, 30026 and 30032, are spring biased towards the position illustrated in Fig. 16X.

[00276] In an exemplary embodiment, as illustrated in Fig. 16Y, the tubular spring housing 30034 may be displaced upwardly in the direction 30098 even if the upper toggle links, 30022 and 30028, and lower toggle links, 30024 and 30030, are positioned within a portion of the expandable wellbore casing 100 that has not been radially expanded and plastically deformed by the system 10.

[00277] In an exemplary embodiment, as illustrated in Figs. 16Z1 to 16Z4, 16AA1 to 16AA4, 16AB1 to 16AB4, 16AC1 to 16AC4, 16AD, and 16AE, the tubular spring housing 30034 of the adjustable casing expansion cone assembly 30 defines internal annular recesses 30034k and 30034l, spaced apart by an internal flange 30034m, the tubular toggle bushing 30008 defines an external annular recess 30008ac, and the adjustable casing expansion cone assembly further includes pins, 30100a and 30100b and 30102a and 30102b, mounted in holes 30008j and 30008o and 30008k and 30008n, respectively, of the tubular toggle bushing, and a one-shot deactivation device 30104 mounted on the tubular toggle bushing between the pins, 30100a and 30100b and 30102a and 30102b.

[00278] The one-shot deactivation device 30104 includes a tubular body 30104a that defines radial holes, 30104b and 30014c, and includes an external annular recess 30104d at one end, a centrally positioned external flange 30104e, a centrally positioned internal annular recess 30104f, and an external annular recess 30104g at another end. An engagement member 30106 that includes a base member 30106a having a tapered end 30106b and a key member 30106c having a tapered end 30106d is received within a portion

of the internal annular recess 30104f of the tubular body 30104a and an engagement member 30108 that includes a base member 30108a having a tapered end 30108b and a key member 30108c having a tapered end 30108d is received within an opposite portion of the internal annular recess 30104f of the tubular body 30104a. Spring members, 30110 and 30112, are received within the annular recess 30104f of the tubular body 30104a for biasing the base members, base member 30106a and 30108a, of the engagement members, 30106 and 30108, respectively, radially inwardly relative to the tubular body 30104a.

[00279] In an exemplary embodiment, during operation of the adjustable bell section expansion cone assembly 28, as illustrated in Fig. 16Z, the one-shot deactivation device 30104 are positioned proximate and in intimate contact with the pins, 30102a and 30102b, with the tapered ends, 30106b and 30108b, of the base members, 30106a and 30108a, of the engagement members, 30106 and 30108, received within the external annular recess 30008ac of the tubular toggle bushing 30008. When the one-shot deactivation device 30104 is positioned as illustrated in Fig. 16Z, the external annular recess 30104d of the tubular body 30104a of the one-shot deactivation device is moved out of engagement with the engagement arms, 30026d and 30032d, of the triggers, 30026 and 30032, respectively. As a result, the triggers, 30026 and 30032, may operate normally as described above with reference to Figs. 16W, 16X, and 16Y.

[00280] Conversely, in an exemplary embodiment, during operation of the adjustable casing expansion cone assembly 30, as illustrated in Figs. 16AA1 to 16AA4, the one-shot deactivation device 30104 are positioned proximate and in intimate contact with the pins, 30100a and 30100b, with the tapered ends, 30106b and 30108b, of the base members, 30106a and 30108a, of the engagement members, 30106 and 30108, not received within the external annular recess 30008ac of the tubular toggle bushing 30008. When the one-shot deactivation device 30104 is positioned as illustrated in Figs. 16AA1 to 16AA4, the external annular recess 30104d of the tubular body 30104a of the one-shot deactivation device is moved into engagement with the engagement arms, 30026d and 30032d, of the triggers, 30026 and 30032, respectively. As a result, the triggers, 30026 and 30032, are deactivated and may not operate normally as described above with reference to Figs. 16W, 16X, and 16Y.

[00281] In an alternative embodiment, the elements of the adjustable casing expansion cone assembly 30 that sense the diameter of the expandable wellbore casing 100 may be disabled or omitted or adjusted to sense any pre-selected internal diameter of the expandable wellbore casing.

[00282] In an exemplary embodiment, as illustrated in 17A to 17C, the packer setting tool assembly 32 includes a tubular adaptor 3202 that defines a longitudinal passage 3202a, radial external mounting holes, 3202b and 3202c, radial passages, 3202d and 3202e, and

includes an external threaded connection 3202f at one end and an internal annular recess 3202g having an internal threaded connection at another end. An external threaded connection 3204a of an end of a tubular upper mandrel 3204 that defines a longitudinal passage 3204b, internally threaded external mounting holes, 3204c and 3204d, and includes an external annular recess 3204e, external annular recess 3204f, external annular recess 3204g, external flange 3204h, external splines 3204i, and an internal threaded connection 3204j at another end is received within and is coupled to the internally threaded connection of the internal annular recess 3202g of the other end of the tubular adaptor 3202. Mounting screws, 3205a and 3205b, are received within and coupled to the mounting holes, 3204c and 3204d, of the tubular upper mandrel 3204 that also extend into the radial passages, 3202d and 3202e, of the tubular adaptor 3202.

[00283] An external threaded connection 3206a of an end of a mandrel 3206 that defines a longitudinal passage 3206b and includes an external annular recess 3206c and an external annular recess 3206d having an external threaded connection is received within and is coupled to the internal threaded connection 3204j of the tubular upper mandrel 3204. An internal threaded connection 3208a of a tubular stinger 3208 that defines a longitudinal passage 3208b and includes an external annular recess 3208c, and an external tapered annular recess 3208d and an engagement shoulder 3208e at another end receives and is coupled to the external threaded connection of the external annular recess 3206d of the mandrel 3206. A sealing member 3210 is mounted upon and coupled to the external annular recess 3206d of the mandrel 3206.

[00284] An internal flange 3212a of a tubular key 3212 that includes an external annular recess 3212b at one end and an internal annular recess 3212c at another end is movably received within and engages the external annular recess 3204f of the tubular upper mandrel 3204. A garter spring 3214 is received within and engages the external annular recess 3212b of the tubular key 3212.

[00285] An end of a tubular bushing 3216 that defines a longitudinal passage 3216a for receiving and mating with the upper mandrel 3204, and radial passages, 3216b and 3216c, and includes an external threaded connection 3216d at an intermediate portion, and an external flange 3216e, an internal annular recess 3216f, circumferentially spaced apart teeth 3216g, and external flanges, 3216h and 3216i, at another end is received within and mates with the internal annular recess 3212c of the tubular key 3212. An internal threaded connection 3218a of a tubular drag block body 3218 that defines a longitudinal passage 3218b for receiving the tubular bushing 3216, mounting holes, 3218c and 3218d, mounting holes, 3218e and 3218f, and includes an internal threaded connection 3218g at one end, a centrally positioned external annular recess 3218h, and an external threaded connection 3218i at another end is received within and coupled to the external threaded connection

3216d of the tubular bushing 3216.

[00286] A first tubular keeper 3220 that defines mounting holes, 3220a and 3220b, is coupled to an end of the tubular drag block body 3218 by mounting screws, 3222a and 3222b, that are received within and are coupled to the mounting holes, 3218c and 3218d, of the tubular drag block body. A second tubular keeper 3224 that defines mounting holes, 3224a and 3224b, is coupled to an end of the tubular drag block body 3218 by mounting screws, 3226a and 3226b, that are received within and are coupled to the mounting holes, 3218e and 3218f, of the tubular drag block body.

[00287] Drag blocks, 3228 and 3230, that are received within the external annular recess 3218h of the tubular drag block body 3218, include ends that mate with and are received within the end of the first tubular keeper 3220, and other ends that mate with and are received within the end of the second tubular keeper 3224. The drag blocks, 3228 and 3230, further include internal annular recesses, 3228a and 3230a, respectively, that receive and mate with ends of springs, 3232 and 3234, respectively. The springs, 3232 and 3234, also receive and mate with the external annular recess 3218h of the tubular drag block body 3218.

[00288] An external threaded connection 3236a of an end of a tubular releasing cap extension 3236 that defines a longitudinal passage 3236b and includes an internal annular recess 3236c and an internal threaded connection 3236d at another end is received within and is coupled to the internal threaded connection 3218g of the tubular drag block body 3218. An external threaded connection 3238a of an end of a tubular releasing cap 3238 that defines a longitudinal passage 3238b and includes an internal annular recess 3238c is received within and coupled to the internal threaded connection 3236d of the tubular releasing cap extension 3236. A sealing element 3240 is received within the internal annular recess 3238c of the tubular releasing cap 3238 for fluidicly sealing the interface between the tubular releasing cap and the upper mandrel 3204.

[00289] An internal threaded connection 3242a of an end of a tubular setting sleeve 3242 that defines a longitudinal passage 3242b, radial passage 3242c, radial passages, 3242d and 3242e, radial passage 3242f, and includes an internal flange 3242g at another end receives the external threaded connection 3218i of the tubular drag block body 3218. An internal flange 3244a of a tubular coupling ring 3244 that defines a longitudinal passage 3244b and radial passages, 3244c and 3244d, receives and mates with the external flange 3216h of the tubular bushing 3216 and an end face of the internal flange of the tubular coupling ring is positioned proximate and in opposing relation to an end face of the external flange 3216i of the tubular bushing.

[00290] An internal flange 3246a of a tubular retaining collet 3246 that includes a plurality of axially extending collet fingers 3246b, each having internal flanges 3246c at an

end of each collet finger, for engaging and receiving the tubular coupling ring 3244 receives and mates with external flange 3216e of the tubular bushing 3216 and an end face of the internal flange of the tubular retaining collet is positioned proximate and in opposing relation to an end face of the external flange 3216h of the tubular bushing.

[00291] In an exemplary embodiment, the packer assembly 36 operates and is provided substantially, at least in part, as disclosed in one or more of the following: (1) PCT patent application serial number PCT/US03/14153, attorney docket number 25791.104.02, filed on 11/13/2003, (2) PCT patent application serial number PCT/US03/29460, attorney docket number 25791.114.02, filed on 9/23/2003, and/or (3) PCT patent application serial number PCT/US04/_____, attorney docket number 25791.253.02, filed on 3/11/2004, and/or (4) PCT patent application serial number PCT/US04/_____, attorney docket number 25791.260, filed on 3/26/2004, the disclosures of which are incorporated herein by reference.

[00292] In an exemplary embodiment, as illustrated in Figs. 18-1 to 18-5, the packer assembly 36 includes a tubular upper adaptor 3602 that defines a longitudinal passage 3602a having a tapered opening 3602b and mounting holes, 3602c and 3602d, that includes a plurality of circumferentially spaced apart teeth 3602e at one end, an external flange 3602f, and an internal threaded connection 3602g at another end. In an exemplary embodiment, the tubular upper adaptor 3602 is fabricated from aluminum. An external threaded connection 3604a of an end of a tubular upper mandrel 3604 that defines a longitudinal passage 3604b, mounting holes, 3604c and 3604d, mounting holes, 3604e and 3604f, and mounting holes, 3604g and 3604h, and includes an external flange 3604i, an internal annular recess 3604j, and an internal threaded connection 3604k at another end is received within and coupled to the internal threaded connection 3602g of the tubular upper adaptor 3602. In an exemplary embodiment, the tubular upper mandrel 3604 is fabricated from aluminum.

[00293] An upper tubular spacer ring 3606 that defines mounting holes, 3606a and 3606b, receives and mates with the end of the tubular upper mandrel 3604 and includes an angled end face 3606c and another end face that is positioned proximate to an end face of the tubular upper adaptor 3602 is coupled to the tubular upper mandrel by shear pins, 3608a and 3608b, that are mounted within and coupled to the mounting holes, 3604c and 3606a, and, 3604d and 3606b, respectively, of the tubular upper mandrel and upper tubular spacer ring, respectively. A lower tubular spacer ring 3610 that includes an angled end face 3610a receives, mates, and is coupled to the other end of the tubular upper mandrel 3604 and includes another end face that is positioned proximate to an end face of the external flange 3604i of the tubular upper mandrel 3604. In an exemplary embodiment, the upper and tubular spacer rings, 3606 and 3610, are fabricated from a composite material.

[00294] An upper tubular slip 3612 that receives and is movably mounted upon the tubular upper mandrel 3604 defines a longitudinal passage 3612a having a tapered opening 3612b and includes external annular recesses, 3612c, 3612d, 3612e, 3612f, and 3612g, and an angled end face 3612h that mates with and is positioned proximate the angled end face 3606c of the upper tubular spacer ring 3606. Slip retaining bands, 3614a, 3614b, 3614c, 3614d, and 3614e, are received within and coupled to the external annular recesses, 3612c, 3612d, 3612e, 3612f, and 3612g, of the upper tubular slip 3612. A lower tubular slip 3616 that receives and is movably mounted upon the tubular upper mandrel 3604 defines a longitudinal passage 3616a having a tapered opening 3616b and includes external annular recesses, 3616c, 3616d, 3616e, 3616f, and 3616g, and an angled end face 3616h that mates with and is positioned proximate the angled end face 3610a of the lower tubular spacer ring 3610. Slip retaining bands, 3618a, 3618b, 3618c, 3618d, and 3618e, are received within and coupled to the external annular recesses, 3616c, 3616d, 3616e, 3616f, and 3616g, of the lower tubular slip 3616. In an exemplary embodiment, the upper and lower tubular slips, 3612 and 3616, are fabricated from composite materials, and at least some of the slip retaining bands, 3614a, 3614b, 3614c, 3614d, 3614e, 3618a, 3618b, 3618c, 3618d, and 3618e are fabricated from carbide insert materials.

[00295] An upper tubular wedge 3620 that defines an longitudinal passage 3620a for receiving the tubular upper mandrel 3604 and mounting holes, 3620b and 3620c, and includes an angled end face 3620d at one end that is received within and mates with the tapered opening 3612b of the upper tubular slip 3612, and an angled end face 3620e at another end is coupled to the tubular upper mandrel by shear pins, 3622a and 3622b, mounted within and coupled to the mounting holes, 3604e and 3620b, and, 3604f and 3620c, respectively, of the tubular upper mandrel and upper tubular wedge, respectively. A lower tubular wedge 3624 that defines an longitudinal passage 3624a for receiving the tubular upper mandrel 3604 and mounting holes, 3624b and 3624c, and includes an angled end face 3624d at one end that is received within and mates with the tapered opening 3616b of the lower tubular slip 3616, and an angled end face 3624e at another end is coupled to the tubular upper mandrel by shear pins, 3626a and 3626b, mounted within and coupled to the mounting holes, 3604g and 3624b, and, 3604h and 3624c, respectively, of the tubular upper mandrel and lower tubular wedge, respectively. In an exemplary embodiment, the upper and lower tubular wedges, 3620 and 3624, are fabricated from composite materials.

[00296] An upper tubular extrusion limiter 3628 that defines a longitudinal passage 3628a for receiving the tubular upper mandrel 3604 includes an angled end face 3628b at one end that mates with the angled end face 3620e of the upper tubular wedge 3620, an angled end face 3628c at another end having recesses 3628d, and external annular recesses, 3628e, 3628f and 3628g. Retaining bands, 3630a, 3630b, and 3630c, are

mounted within and coupled to the external annular recesses, 3628e, 3628f and 3628g, respectively, of the upper tubular extrusion limiter 3628. Circular disc-shaped extrusion preventers 3632 are coupled and mounted within the recesses 3628d. A lower tubular extrusion limiter 3634 that defines a longitudinal passage 3634a for receiving the tubular upper mandrel 3604 includes an angled end face 3634b at one end that mates with the angled end face 3624e of the lower tubular wedge 3624, an angled end face 3634c at another end having recesses 3634d, and external annular recesses, 3634e, 3634f and 3634g. Retaining bands, 3636a, 3636b, and 3636c, are mounted within and coupled to the external annular recesses, 3634e, 3634f and 3634g, respectively, of the lower tubular extrusion limiter 3634. Circular disc-shaped extrusion preventers 3638 are coupled and mounted within the recesses 3634d. In an exemplary embodiment, the upper and lower extrusion limiters, 3628 and 3634, are fabricated from composite materials.

[00297] An upper tubular elastomeric packer element 3640 that defines a longitudinal passage 3640a for receiving the tubular upper mandrel 3604 includes an angled end face 3640b at one end that mates with and is positioned proximate the angled end face 3628c of the upper tubular extrusion limiter 3628 and an curved end face 3640c at another end. A lower tubular elastomeric packer element 3642 that defines a longitudinal passage 3642a for receiving the tubular upper mandrel 3604 includes an angled end face 3642b at one end that mates with and is positioned proximate the angled end face 3634c of the lower tubular extrusion limiter 3634 and an curved end face 3642c at another end.

[00298] A central tubular elastomeric packer element 3644 that defines a longitudinal passage 3644a for receiving the tubular upper mandrel 3604 includes a curved outer surface 3644b for mating with and engaging the curved end faces, 3640c and 3642c, of the upper and lower tubular elastomeric packer elements, 3640 and 3642, respectively.

[00299] An external threaded connection 3646a of a tubular lower mandrel 3646 that defines a longitudinal passage 3646b having throat passages, 3646c and 3646d, and flow ports, 3646e and 3646f, and a mounting hole 3646g, and includes an internal annular recess 3646h at one end, and an external flange 3646i, internal annular recess 3646j, and internal threaded connection 3646k at another end. In an exemplary embodiment, the tubular lower mandrel 3646 is fabricated from aluminum. A sealing element 3648 is received within the inner annular recess 3604j of the other end of the tubular upper mandrel 3604 for sealing an interface between the tubular upper mandrel and the tubular lower mandrel 3646.

[00300] A tubular sliding sleeve valve 3650 that defines a longitudinal passage 3650a and radial flow ports, 3650b and 3650c, and includes collet fingers 3650d at one end for engaging the internal annular recess 3646h of the lower tubular mandrel 3646, an external annular recess 3650e, an external annular recess 3650f, an external annular recess 3650g, and circumferentially spaced apart teeth 3650h at another end is received within and is

slidably coupled to the longitudinal passage 3646b of the tubular lower mandrel 3646. In an exemplary embodiment, the tubular sliding sleeve valve 3650 is fabricated from aluminum. A set screw 3652 is mounted within and coupled to the mounting hole 3646g of the tubular lower mandrel 3646 that is received within the external annular recess 3650e of the tubular sliding sleeve 3650. Sealing elements, 3654 and 3656, are mounted within the external annular recesses, 3650f and 3650g, respectively, of the tubular sliding sleeve valve 3650 for sealing an interface between the tubular sliding sleeve valve and the tubular lower mandrel 3646.

[00301] An end of a tubular outer sleeve 3658 that defines a longitudinal passage 3658a, radial passages, 3658b and 3658c, upper flow ports, 3658d and 3658e, lower flow ports, 3658f and 3658g, and radial passages, 3658h and 3658i, receives, mates with, and is coupled to the other end of the tubular upper mandrel 3604 and an end face of the end of the tubular outer sleeve is positioned proximate and end face of the lower tubular spacer ring 3610. The other end of the tubular outer sleeve 3658 receives, mates with, and is coupled to the other end of the tubular lower mandrel 3646.

[00302] An external threaded connection 3660a of an end of a tubular bypass mandrel 3660 that defines a longitudinal passage 3660b, upper flow ports, 3660c and 3660d, lower flow ports, 3660e and 3660f, and a mounting hole 3660g and includes an internal annular recess 3660h and an external threaded connection 3660i at another end is received within and coupled to the internal threaded connection 3646k of the tubular lower mandrel 3646. A sealing element 3662 is received within the internal annular recess 3646j of the tubular lower mandrel 3646 for sealing an interface between the tubular lower mandrel and the tubular bypass mandrel 3660.

[00303] A tubular plug seat 3664 that defines a longitudinal passage 3664a having a tapered opening 3664b at one end, and flow ports, 3664c and 3664d, and includes an external annular recess 3664e, an external annular recess 3664f, an external annular recess 3664g, an external annular recess 3664h, and an external annular recess 3664i having an external threaded connection at another end is received within and is movably coupled to the longitudinal passage 3660b of the tubular bypass mandrel 3660. A tubular nose 3666 is threadably coupled to and mounted upon the external annular recess 3664i of the tubular plug seat 3664. In an exemplary embodiment, the tubular plug seat 3664 is fabricated from aluminum. Sealing elements, 3668, 3670, and 3672, are received within the external annular recesses, 3664e, 3664g, and 3664h, respectively, of the tubular plug seat 3664 for sealing an interface between the tubular plug seat and the tubular bypass mandrel 3660. A set screw 3674 is mounted within and coupled to the mounting hole 3660g of the tubular bypass mandrel 3660 that is received within the external annular recess 3664f of the tubular plug seat 3664.

[00304] An end of a tubular bypass sleeve 3676 that defines a longitudinal passage 3676a and includes an internal annular recess 3676b at one end and an internal threaded connection 3676c at another end is coupled to the other end of the tubular outer sleeve 3658 and mates with and receives the tubular bypass mandrel 3660. In an exemplary embodiment, the tubular bypass sleeve 3676 is fabricated from aluminum.

[00305] An external threaded connection 3678a of a tubular valve seat 3678 that defines a longitudinal passage 3678b including a valve seat 3678c and up-jet flow ports, 3678d and 3678e, and includes a spring retainer 3678f and an external annular recess 3678g is received within and is coupled to the internal threaded connection 3676c of the tubular bypass sleeve 3676. In an exemplary embodiment, the tubular valve seat 3678 is fabricated from aluminum. A sealing element 3680 is received within the external annular recess 3678g of the tubular valve seat 3678 for fluidicly sealing an interface between the tubular valve seat and the tubular bypass sleeve 3676.

[00306] A poppet valve 3682 mates with and is positioned within the valve seat 3678c of the tubular valve seat 3678. An end of the poppet valve 3682 is coupled to an end of a stem bolt 3684 that is slidingly supported for longitudinal displacement by the spring retainer 3678f A valve spring 3686 that surrounds a portion of the stem bolt 3684 is positioned in opposing relation to the head of the stem bolt and a support 3678fa of the spring retainer 3678f.for biasing the poppet valve 3682 into engagement with the valve seat 3678c of the tubular valve seat 3678.

[00307] An end of a composite nose 3688 that defines a longitudinal passage 3688a and mounting holes, 3688b and 3688c, and includes an internal threaded connection 3688d at another end receives, mates with, and is coupled to the other end of the tubular valve seat 3678. A tubular nose sleeve 3690 that defines mounting holes, 3690a and 3690b, is coupled to the composite nose 3688 by shear pins, 3692a and 3692b, that are mounted in and coupled to the mounting holes, 3688b and 3690a, and, 3688c and 3690b, respectively, of the composite nose and tubular nose sleeve, respectively.

[00308] An external threaded connection 3694a of a baffle nose 3694 that defines longitudinal passages, 3694b and 3694c, is received within and is coupled to the internal threaded connection internal threaded connection 3688d of the composite nose 3688.

[00309] In an exemplary embodiment, as illustrated in Figs. 19A1 to 19A5, during the operation of the packer setting tool assembly 32 and packer assembly 36, the packer setting tool and packer assembly are coupled to one another by inserting the end of the tubular upper adaptor 3602 into the other end of the tubular coupling ring 3244, bringing the circumferentially spaced teeth 3216g of the other end of the tubular bushing 3216 into engagement with the circumferentially spaced teeth 3602e of the end of the tubular upper adaptor, and mounting shear pins, 36100a and 36100b, within the mounting holes, 3244c

and 3602c, and, 3244d and 3602d, respectively, of the tubular coupling ring and tubular upper adaptor, respectively. As a result, the tubular mandrel 3206 and tubular stinger 3208 of the packer setting tool assembly 32 are thereby positioned within the longitudinal passage 3604a of the tubular upper mandrel 3604 with the 3208e of the tubular stinger positioned within the longitudinal passage 3646b of the tubular lower mandrel 3646 proximate the collet fingers 3650d of the tubular sliding sleeve valve 3650.

[00310] Furthermore, in an exemplary embodiment, during the operation of the packer setting tool 32 and packer assembly 36, as illustrated in Figs. 19A1 to 19A5, the packer setting tool and packer assembly are positioned within the expandable wellbore casing 100 and an internal threaded connection 30a of an end of the adjustable casing expansion cone assembly 30 receives and is coupled to the external threaded connection 3202f of the end of the tubular adaptor 3202 of the packer setting tool assembly. Furthermore, shear pins, 36102a and 36102b, mounted within the mounting holes, 3658b and 3658c, of the tubular outer sleeve 3658 couple the tubular outer sleeve to the expandable wellbore casing. As a result, torsion loads may transferred between the tubular outer sleeve 3658 and the expandable wellbore casing 100.

[00311] In an exemplary embodiment, as illustrated in Figs. 19B1 to 19B5, a conventional plug 36104 is then injected into the setting tool assembly 32 and packer assembly 36 by injecting a fluidic material 36106 into the setting tool assembly and packer assembly through the longitudinal passages, 3202a, 3204b, 3206b, 3208b, 3650a, 3646a, 3660b, and 3664a of the tubular adaptor 3202, tubular upper mandrel 3204, tubular mandrel 3206, tubular stinger 3208, tubular sliding sleeve valve 3650, tubular lower mandrel 3646, tubular bypass mandrel 3660, and tubular plug seat 3664, respectively. The plug 36104 is thereby positioned within the longitudinal passage 3664a of the tubular plug seat 3664. Continued injection of the fluidic material 36106 following the seating of the plug 1606 within the longitudinal passage 3664a of the tubular plug seat 3664 causes the plug and the tubular plug seat to be displaced downwardly in a direction 36108 until further movement of the tubular plug seat is prevented by interaction of the set screw 3674 with the external annular recess 3664f of the tubular plug seat. As a result, the flow ports, 3664c and 3664d, of the tubular plug seat 3664 are moved out of alignment with the upper flow ports, 3660c and 3660d, of the tubular bypass mandrel 3660.

[00312] In an exemplary embodiment, as illustrated in Figs. 19C1 to 19C5, after the expandable wellbore casing 100 has been radially expanded and plastically deformed to form at least the bell section 112 of the expandable wellbore casing 100 thereby shearing the shear pins, 36102a and 36102b, the setting tool assembly 32 and packer assembly 36 are then moved upwardly to a position within the expandable wellbore casing 100 above the bell section. The tubular adaptor 3202 is then rotated, by rotating the tool string of the

system 10 above the setting tool assembly 32, to displace and position the drag blocks, 3228 and 3230, into engagement with the interior surface of the expandable wellbore casing 100.

[00313] As a result of the engagement of the drag blocks, 3228 and 3230, with the interior surface of the expandable wellbore casing 100, further rotation of the drag blocks relative to the wellbore casing is prevented. Consequently, due to the operation and interaction of the threaded connections, 3216d and 3218a, of the tubular bushing 3216 and tubular drag block body 3218, respectively, further rotation of the tubular adaptor 3202 causes the tubular drag block body and setting sleeve 3242 to be displaced downwardly in a direction 36112 relative to the remaining elements of the setting tool assembly 32 and packer assembly 36. As a result, the setting sleeve 3242 engages and displaces the upper tubular spacer ring 3606 thereby shearing the shear pins, 3622a and 3622b, and driving the upper tubular slip 3612 onto and up the angled end face 3620d of the upper tubular wedge 3620 and into engagement with the interior surface of the expandable wellbore casing 100. As a result, longitudinal displacement of the upper tubular slip 3612 relative to the expandable wellbore casing 100 is prevented. Furthermore, as a result, the 3246b collet fingers of the tubular retaining collet 3246 are disengaged from the tubular upper adaptor 3602.

[00314] In an alternative embodiment, after the drag blocks, 3228 and 3230, engage the interior surface of the expandable wellbore casing 100, an upward tensile force is applied to the tubular support member 12, and the ball gripper assembly 16 is then operate to engage the interior surface of the expandable wellbore casing. The tension actuator assembly 18 is then operated to apply an upward tensile force to the tubular adaptor 3202 thereby pulling the upper tubular spacer ring 3606, lower tubular spacer ring 3610, upper tubular slip 3612, lower tubular slip 3616, upper tubular wedge 3620, lower tubular wedge 3624, upper tubular extrusion limiter 3628, lower tubular extrusion limiter 3634, and central tubular elastomeric element 3644 upwardly into contact with the 3242 thereby compressing the upper tubular spacer ring, lower tubular spacer ring, upper tubular slip, lower tubular slip, upper tubular wedge, lower tubular wedge, upper tubular extrusion limiter, lower tubular extrusion limiter, and central tubular elastomeric element. As a result, the upper tubular slip 3612, lower tubular slip 3616, and central tubular elastomeric element 3644 engage the interior surface of the expandable wellbore casing 100.

[00315] In an exemplary embodiment, as illustrated in Figs. 19D1 to 19D5, an upward tensile force is then applied to the tubular adaptor 3202 thereby compressing the lower tubular slip 3616, lower tubular wedge 3624, central elastomeric packer element 3644, upper tubular extrusion limiter 3628, and upper tubular wedge 3620 between the lower tubular spacer ring 3610 and the stationary upper tubular slip 3612. As a result, the lower tubular

slip 3616 is driven onto and up the angled end face 3624d of the lower tubular wedge 3624 and into engagement with the interior surface of the expandable wellbore casing 100, and the central elastomeric packer element 3644 is compressed radially outwardly into engagement with the interior surface of the expandable tubular member. As a result, further longitudinal displacement of the upper tubular slip 3612, lower tubular slip 3616, and central elastomeric packer element 3644 relative to the expandable wellbore casing 100 is prevented.

[00316] In an exemplary embodiment, as illustrated in Figs. 19E1 to 19E6, continued application of the upward tensile force to tubular adaptor 3202 will then shear the shear pins, 1602a and 1602b, thereby disengaging the setting tool assembly 32 from the packer assembly 36.

[00317] In an exemplary embodiment, as illustrated in Figs. 19F1 to 19F6, with the drag blocks, 3228 and 3230, in engagement with the interior surface of the expandable wellbore casing 100, the tubular adaptor 102 is further rotated thereby causing the tubular drag block body 3218 and setting sleeve 3242 to be displaced further downwardly in the direction 1612 until the tubular drag block body and setting sleeve are disengaged from the tubular stinger 3208. As a result, the tubular stinger 3208 of the setting tool assembly 32 may then be displaced downwardly into complete engagement with the tubular sliding sleeve valve 3650.

[00318] In an exemplary embodiment, as illustrated in Figs. 19G1 to 19G6, a fluidic material 36114 is then injected into the setting tool assembly 32 and the packer assembly 36 through the longitudinal passages 3202a, 3204b, 3206b, 3208b, 3604b, 3650a, and 3646b of the tubular adaptor 3202, tubular upper mandrel 3204, tubular mandrel 3206, tubular stinger 3208, tubular upper mandrel 3604, tubular sliding sleeve valve 3650, and tubular lower mandrel 3646, respectively. Because, the plug 36104 is seated within and blocks the longitudinal passage 3664a of the tubular plug seat 3664, the longitudinal passages 3604b, 3650a, and 3646b of the tubular upper mandrel 3604, tubular sliding sleeve valve 3650, and tubular lower mandrel 3646 are pressurized thereby displacing the tubular upper adaptor 3602 and tubular upper mandrel 3604 downwardly until the end face of the tubular upper mandrel impacts the end face of the upper tubular spacer ring 3606.

[00319] In an exemplary embodiment, as illustrated in Figs. 19H1 to 19H5, the setting tool assembly 32 is brought back into engagement with the packer assembly 36 until the engagement shoulder 3208e of the other end of the tubular stinger 3208 engages the collet fingers 3650d of the end of the tubular sliding sleeve valve 3650. As a result, further downward displacement of the tubular stinger 3208 displaces the tubular sliding sleeve valve 3650 downwardly until the radial flow ports, 3650b and 3650c, of the tubular sliding sleeve valve are aligned with the flow ports, 3646e and 3646f, of the tubular lower mandrel 3646. A

hardenable fluidic sealing material 36116 may then be injected into the setting tool assembly 32 and the packer assembly 36 through the longitudinal passages 3202a, 3204b, 3206b, 3208b, and 3650a of the tubular adaptor 3202, tubular upper mandrel 3204, tubular mandrel 3206, tubular stinger 3208, and tubular sliding sleeve valve 3650, respectively. The hardenable fluidic sealing material may then flow out of the packer assembly 36 through the upper flow ports, 3658d and 3658e, into the annulus between the expandable wellbore casing 100 and the wellbore 102.

[00320] The tubular sliding sleeve valve 3650 may then be returned to its original position, with the radial flow ports, 3650b and 3650c, of the tubular sliding sleeve valve out of alignment with the flow ports, 3646e and 3646f, of the tubular lower mandrel 3646. The hardenable fluidic sealing material 36116 may then be allowed to cure before, during, or after the continued operation of the system 10 to further radially expand and plastically deform the expandable wellbore casing.

[00321] In an alternative embodiment, as illustrated in Figs. 20 and 20A to 20AX, the packer assembly 36 includes an upper tubular spacer ring 36200 receives and mates with the end of the tubular upper mandrel 3604 and includes an angled end face 36200a that includes a plurality of spaced apart radial grooves 36200b and another end face that is positioned proximate to an end face of the tubular upper adaptor 3602 is coupled to the tubular upper mandrel by shear pins, 36202a, 36202b, 36202c, and 36202d. A lower tubular spacer ring 36204 that includes an angled end face 36204a that includes a plurality of spaced apart radial grooves 36204b receives, mates, and is coupled to the other end of the tubular upper mandrel 3604 and includes another end face that is positioned proximate to an end face of the external flange 3604i of the tubular upper mandrel 3604. In an exemplary embodiment, the upper and tubular spacer rings, 3606 and 3610, are fabricated from a composite material.

[00322] An upper tubular slip assembly 36206 that receives and is movably mounted upon the tubular upper mandrel 3604 includes a plurality of substantially identical slip elements 36206a that each include an exterior arcuate cylindrical surface 36206aa including mounting holes, 36206ab, 36206ac, 36206ad, 36206ae, 36206af, 36206ag, 36206ah, 36206ai, and 36206aj, and grooves, 36206aj and 36206ak, a front end face 36206al, a rear end face 36206am including a mounting hole 36206an, side faces, 36206ao and 36206ap, an interior arcuate cylindrical surface 36206aq that mates with the exterior surface of the tubular upper mandrel 3604, and an interior tapered surface 36206ar including a mounting hole 36206as. Mounting pins 36206at are received within and coupled to the mounting holes 36206an and are received within corresponding radial grooves 36200b of the angled end face 36200a of the upper tubular spacer ring 36200. Retaining pins 36206au are mounted within and coupled to the mounting holes 36206as that include heads 36206av.

Slip retaining bands, 36206aw and 36206ax, are received within and coupled to grooves, 36206aj and 36206ak, respectively, of the slip elements 36206a. Slip gripping elements, 36206ay, 36206az, 36206aaa, 36206aab, 36206aac, 36206aad, 36206aae, 36206aaf, and 36206aag, are mounted within, coupled to, and extend out of the mounting holes, 36206ab, 36206ac, 36206ad, 36206ae, 36206af, 36206ag, 36206ah, 36206ai, and 36206aj, respectively. In an exemplary embodiment, the adjacent exterior arcuate cylindrical surfaces 36206aa of the identical slip elements 36206a of the upper tubular slip assembly 36206 together define a substantially contiguous cylindrical surface.

[00323] A lower tubular slip assembly 36208 that receives and is movably mounted upon the tubular upper mandrel 3604 includes a plurality of substantially identical slip elements 36208a that each include an exterior arcuate cylindrical surface 36208aa including mounting holes, 36208ab, 36208ac, 36208ad, 36208ae, 36208af, 36208ag, 36208ah, 36208ai, and 36208aj, and grooves, 36208aj and 36208ak, a front end face 36208al, a rear end face 36208am including a mounting hole 36208an, side faces, 36208ao and 36208ap, an interior arcuate cylindrical surface 36208aq that mates with the exterior surface of the tubular upper mandrel 3604, and an interior tapered surface 36208ar including a mounting hole 36208as. Mounting pins 36208at are received within and coupled to the mounting holes 36208an and are received within corresponding radial grooves 36204b of the angled end face 36204a of the lower tubular spacer ring 36204. Retaining pins 36208au are mounted within and coupled to the mounting holes 36208as that include heads 36208av. Slip retaining bands, 36208aw and 36208ax, are received within and coupled to grooves, 36208aj and 36208ak, respectively, of the slip elements 36208a. Slip gripping elements, 36208ay, 36208az, 36208aaa, 36208aab, 36208aac, 36208aad, 36208aae, 36208aaf, and 36208aag, are mounted within, coupled to, and extend out of the mounting holes, 36208ab, 36208ac, 36208ad, 36208ae, 36208af, 36208ag, 36208ah, 36208ai, and 36208aj, respectively. In an exemplary embodiment, the adjacent exterior arcuate cylindrical surfaces 36208aa of the identical slip elements 36208a of the upper tubular slip assembly 36208 together define a substantially contiguous cylindrical surface.

[00324] An upper tubular wedge 36210 that receives the tubular upper mandrel 3604 includes an angled front end face 36210a including spaced apart radial grooves 36210b, a rear end face 36210c, an exterior cylindrical surface 36210d, a plurality of spaced apart faceted tapered exterior surface segments 36210e that mate with corresponding tapered internal surfaces 36206ar of corresponding slip elements 36206a of the upper tubular slip assembly 36206, and T-shaped exterior grooves 36210f aligned with the midline of corresponding faceted tapered exterior surface segments that extend from the angled end face to the rear end face that receive and mate with corresponding retaining pins 36206au of corresponding slip elements of the upper tubular slip assembly. The upper tubular wedge

36210 is releasably coupled to the tubular upper mandrel 3604 by shear pins 36211.

[00325] A lower tubular wedge 36212 that receives the tubular upper mandrel 3604 includes an angled front end face 36212a including spaced apart radial grooves 36212b, a rear end face 36212c, an exterior cylindrical surface 36212d, a plurality of spaced apart faceted tapered exterior surface segments 36212e that mate with corresponding tapered internal surfaces 36208ar of corresponding slip elements 36208a of the upper tubular slip assembly 36208, and T-shaped exterior grooves 36212f aligned with the midline of corresponding faceted tapered exterior surface segments that extend from the angled end face to the rear end face that receive and mate with corresponding retaining pins 36208au of corresponding slip elements of the lower tubular slip assembly. The lower tubular wedge 36212 is releasably coupled to the tubular upper mandrel 3604 by shear pins 36213.

[00326] An upper tubular extrusion limiter assembly 36214 that receives and is movably mounted upon the tubular upper mandrel 3604 includes a plurality of substantially identical extrusion limiter elements 36214a that each include an angled front end face 36214aa having a recessed portion 36214ab, an angled rear end face 36214ac that defines a mounting hole 36214ad, an interior arcuate cylindrical surface 36214ae that mates with the tubular upper mandrel, and an exterior arcuate cylindrical surface 36214af including grooves, 36214ag, 36214ah, and 36214ai. Disk extrusion preventers 36214aj are mounted within and coupled to the recessed portions 36214ab of adjacent extrusion limiter elements 36214a, and mounting pins 36214ak are mounted within and coupled to mounting holes 36214ad of corresponding extrusion limiter elements 36214a that are received within corresponding radial grooves 36210b of the front end face 36210a of the upper tubular wedge 36210. Retaining bands, 36214al, 36214am, and 36214an, are positioned within and coupled to the grooves, 36214ai, 36214ah, and 36214ag, respectively, of the extrusion limiter elements 36214a.

[00327] A lower tubular extrusion limiter assembly 36216 that receives and is movably mounted upon the tubular upper mandrel 3604 includes a plurality of substantially identical extrusion limiter elements 36216a that each include an angled front end face 36216aa having a recessed portion 36216ab, an angled rear end face 36216ac that defines a mounting hole 36216ad, an interior arcuate cylindrical surface 36216ae that mates with the tubular upper mandrel, and an exterior arcuate cylindrical surface 36216af including grooves, 36216ag, 36216ah, and 36216ai. Disk extrusion preventers 36216aj are mounted within and coupled to the recessed portions 36216ab of adjacent extrusion limiter elements 36216a, and mounting pins 36216ak are mounted within and coupled to mounting holes 36216ad of corresponding extrusion limiter elements 36216a that are received within corresponding radial grooves 36212b of the front end face 36212a of the lower tubular wedge 36212. Retaining bands, 36216al, 36216am, and 36216an, are positioned within and

coupled to the grooves, 36216ag, 36216ah, and 36216ai, of the extrusion limiter elements 36216a.

[00328] The angled end face 3640b of the upper tubular elastomeric packer element 3640 mates with and is positioned proximate the angled end faces 36214aa and disk extrusion preventers 36214aj of the extrusion limiter elements 36214a of the upper tubular extrusion limiter assembly 36214, and the angled end face 3642b of the lower tubular elastomeric packer element 3642 mates with and is positioned proximate the angled end faces 36216aa and disk extrusion preventers 36216aj of the extrusion limiter elements 36216a of the lower tubular extrusion limiter assembly 36216.

[00329] During operation of the alternative embodiment of the packer assembly 36 described above with reference to Figs. 20 and 20A to 20AX, the first step in setting the packer assembly 36 includes pushing the slip elements, 36206a and 36208a, of the upper and lower slip assemblies, 36206 and 36208, respectively, up the upper and lower tubular wedges, 36210 and 36212, respectively, which breaks the retaining rings, 36206aw and 36206ax, and 36208aw and 36208ax, respectively, and moves the slip elements outwardly against the interior surface of the expandable wellbore casing 100. In an exemplary embodiment, during the radial displacement of the slip elements, 36206a and 36208a, the retaining pins, 36206au and 36208au, respectively, and the mounting pins, 36206at and 36208at, respectively, maintain the slip elements in an evenly spaced apart configuration. In an exemplary embodiment, during the operation of the packer assembly 36, the mounting pins, 36214ak and 36216ak, maintain the extrusion limiter elements, 36214a and 36216a, of the upper and lower tubular extrusion limiter assemblies, 36214 and 36216, respectively, in an evenly spaced apart configuration.

[00330] An apparatus for radially expanding and plastically deforming an expandable tubular member has been described that includes a support member, a cutting device for cutting the tubular member coupled to the support member, and an expansion device for radially expanding and plastically deforming the tubular member coupled to the support member. In an exemplary embodiment, the apparatus further includes a gripping device for gripping the tubular member coupled to the support member. In an exemplary embodiment, the gripping device comprises a plurality of movable gripping elements. In an exemplary embodiment, the gripping elements are moveable in a radial direction relative to the support member. In an exemplary embodiment, the gripping elements are moveable in an axial direction relative to the support member. In an exemplary embodiment, the gripping elements are moveable in a radial and an axial direction relative to the support member. In an exemplary embodiment, the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the

tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in a radial and an axial direction relative to the support member. In an exemplary embodiment, the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in a radial direction relative to the support member. In an exemplary embodiment, the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in an axial direction relative to the support member. In an exemplary embodiment, if the tubular member is displaced in a first axial direction, the gripping device grips the tubular member; and, if the tubular member is displaced in a second axial direction, the gripping device does not grip the tubular member. In an exemplary embodiment, the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, the gripping elements are biased to remain in the first position. In an exemplary embodiment, the gripping device further includes an actuator for moving the gripping elements from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and

[00331] wherein the actuator is a fluid powered actuator. In an exemplary embodiment, the apparatus further includes a sealing device for sealing an interface with the tubular member coupled to the support member. In an exemplary embodiment, the sealing device seals an annulus defines between the support member and the tubular member. In an exemplary embodiment, the apparatus further includes a locking device for locking the position of the tubular member relative to the support member. In an exemplary embodiment, the apparatus further includes a packer assembly coupled to the support member. In an exemplary embodiment, the packer assembly includes a packer; and a packer control device for controlling the operation of the packer coupled to the support member. In an exemplary embodiment, the packer includes: a support member defining a passage; a shoe comprising a float valve coupled to an end of the support member; one or more compressible packer elements movably coupled to the support member; and a sliding sleeve valve movably positioned within the passage of the support member. In an exemplary embodiment, the packer control device includes a support member; one or more

drag blocks releasably coupled to the support member; and a stinger coupled to the support member for engaging the packer. In an exemplary embodiment, the packer includes a support member defining a passage; a shoe comprising a float valve coupled to an end of the support member; one or more compressible packer elements movably coupled to the support member; and a sliding sleeve valve positioned within the passage of the support member; and wherein the packer control device includes: a support member; one or more drag blocks releasably coupled to the support member; and a stinger coupled to the support member for engaging the sliding sleeve valve. In an exemplary embodiment, the apparatus further includes an actuator for displacing the expansion device relative to the support member. In an exemplary embodiment, the actuator includes a first actuator for pulling the expansion device; and a second actuator for pushing the expansion device. In an exemplary embodiment, the actuator includes means for transferring torsional loads between the support member and the expansion device. In an exemplary embodiment, the first and second actuators include means for transferring torsional loads between the support member and the expansion device. In an exemplary embodiment, the actuator includes a plurality of pistons positioned within corresponding piston chambers. In an exemplary embodiment, the cutting device includes a support member; and a plurality of movable cutting elements coupled to the support member. In an exemplary embodiment, the apparatus further includes an actuator coupled to the support member for moving the cutting elements between a first position and a second position; wherein in the first position, the cutting elements do not engage the tubular member; and wherein in the second position, the cutting elements engage the tubular member. In an exemplary embodiment, the apparatus further includes a sensor coupled to the support member for sensing the internal diameter of the tubular member. In an exemplary embodiment, the sensor prevents the cutting elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value. In an exemplary embodiment, the cutting elements includes a first set of cutting elements; and a second set of cutting elements; wherein the first set of cutting elements are interleaved with the second set of cutting elements. In an exemplary embodiment, in the first position, the first set of cutting elements are not axially aligned with the second set of cutting elements. In an exemplary embodiment, in the second position, the first set of cutting elements are axially aligned with the second set of cutting elements. In an exemplary embodiment, the expansion device includes a support member; and a plurality of movable expansion elements coupled to the support member. In an exemplary embodiment, apparatus further includes an actuator coupled to the support member for moving the expansion elements between a first position and a second position; wherein in the first position, the expansion elements do not engage the tubular member; and wherein in the second position, the expansion elements engage the tubular member. In an

exemplary embodiment, the apparatus further includes a sensor coupled to the support member for sensing the internal diameter of the tubular member. In an exemplary embodiment, the sensor prevents the expansion elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value. In an exemplary embodiment, the expansion elements include a first set of expansion elements; and a second set of expansion elements; wherein the first set of expansion elements are interleaved with the second set of expansion elements. In an exemplary embodiment, in the first position, the first set of expansion elements are not axially aligned with the second set of expansion elements. In an exemplary embodiment, in the second position, the first set of expansion elements are axially aligned with the second set of expansion elements. In an exemplary embodiment, the expansion device includes an adjustable expansion device. In an exemplary embodiment, the expansion device includes a plurality of expansion devices. In an exemplary embodiment, at least one of the expansion devices includes an adjustable expansion device. In an exemplary embodiment, the adjustable expansion device includes a support member; and a plurality of movable expansion elements coupled to the support member. In an exemplary embodiment, the apparatus further includes an actuator coupled to the support member for moving the expansion elements between a first position and a second position; wherein in the first position, the expansion elements do not engage the tubular member; and wherein in the second position, the expansion elements engage the tubular member. In an exemplary embodiment, the apparatus further includes a sensor coupled to the support member for sensing the internal diameter of the tubular member. In an exemplary embodiment, the sensor prevents the expansion elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value. In an exemplary embodiment, the expansion elements include a first set of expansion elements; and a second set of expansion elements; wherein the first set of expansion elements are interleaved with the second set of expansion elements. In an exemplary embodiment, in the first position, the first set of expansion elements are not axially aligned with the second set of expansion elements. In an exemplary embodiment, in the second position, the first set of expansion elements are axially aligned with the second set of expansion elements.

[00332] An apparatus for radially expanding and plastically deforming an expandable tubular member has been described that includes a support member, an expansion device for radially expanding and plastically deforming the tubular member coupled to the support member, and an actuator coupled to the support member for displacing the expansion device relative to the support member. In an exemplary embodiment, the apparatus further includes a cutting device coupled to the support member for cutting the tubular member. In an exemplary embodiment, the cutting device includes a support member; and a plurality of

movable cutting elements coupled to the support member. In an exemplary embodiment, the apparatus further includes an actuator coupled to the support member for moving the cutting elements between a first position and a second position; wherein in the first position, the cutting elements do not engage the tubular member; and wherein in the second position, the cutting elements engage the tubular member. In an exemplary embodiment, the apparatus further includes a sensor coupled to the support member for sensing the internal diameter of the tubular member. In an exemplary embodiment, the sensor prevents the cutting elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value. In an exemplary embodiment, the cutting elements include a first set of cutting elements; and a second set of cutting elements; wherein the first set of cutting elements are interleaved with the second set of cutting elements. In an exemplary embodiment, in the first position, the first set of cutting elements are not axially aligned with the second set of cutting elements. In an exemplary embodiment, in the second position, the first set of cutting elements are axially aligned with the second set of cutting elements. In an exemplary embodiment, the apparatus further includes a gripping device for gripping the tubular member coupled to the support member. In an exemplary embodiment, the gripping device includes a plurality of movable gripping elements. In an exemplary embodiment, the gripping elements are moveable in a radial direction relative to the support member. In an exemplary embodiment, the gripping elements are moveable in an axial direction relative to the support member. In an exemplary embodiment, the gripping elements are moveable in a radial and an axial direction relative to the support member. In an exemplary embodiment, the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in a radial and an axial direction relative to the support member. In an exemplary embodiment, the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in a radial direction relative to the support member. In an exemplary embodiment, the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in an axial direction relative to the support member. In an exemplary embodiment, if the tubular member is displaced in a first axial

direction, the gripping device grips the tubular member; and wherein, if the tubular member is displaced in a second axial direction, the gripping device does not grip the tubular member. In an exemplary embodiment, the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, the gripping elements are biased to remain in the first position. In an exemplary embodiment, the gripping device further includes an actuator for moving the gripping elements from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein the actuator is a fluid powered actuator. In an exemplary embodiment, the apparatus further includes a sealing device for sealing an interface with the tubular member coupled to the support member. In an exemplary embodiment, the sealing device seals an annulus defines between the support member and the tubular member. In an exemplary embodiment, the apparatus further includes a locking device for locking the position of the tubular member relative to the support member. In an exemplary embodiment, the apparatus further includes a packer assembly coupled to the support member. In an exemplary embodiment, the packer assembly includes a packer; and a packer control device for controlling the operation of the packer coupled to the support member. In an exemplary embodiment, the packer includes a support member defining a passage; a shoe comprising a float valve coupled to an end of the support member; one or more compressible packer elements movably coupled to the support member; and a sliding sleeve valve movably positioned within the passage of the support member. In an exemplary embodiment, the packer control device includes a support member; one or more drag blocks releasably coupled to the support member; and a stinger coupled to the support member for engaging the packer. In an exemplary embodiment, the packer includes a support member defining a passage; a shoe comprising a float valve coupled to an end of the support member; one or more compressible packer elements movably coupled to the support member; and a sliding sleeve valve positioned within the passage of the support member; and wherein the packer control device comprises: a support member; one or more drag blocks releasably coupled to the support member; and a stinger coupled to the support member for engaging the sliding sleeve valve. In an exemplary embodiment, the expansion device includes a support member; and a plurality of movable expansion elements coupled to the support member. In an exemplary embodiment, the apparatus further includes an actuator coupled to the support member for moving the expansion elements between a first position and a second position; wherein in the first position, the expansion elements do not engage the tubular member; and wherein in the second position, the expansion elements engage the tubular member. In an

exemplary embodiment, the apparatus further includes a sensor coupled to the support member for sensing the internal diameter of the tubular member. In an exemplary embodiment, the sensor prevents the expansion elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value. In an exemplary embodiment, the expansion elements include a first set of expansion elements; and a second set of expansion elements; wherein the first set of expansion elements are interleaved with the second set of expansion elements. In an exemplary embodiment, the in the first position, the first set of expansion elements are not axially aligned with the second set of expansion elements. In an exemplary embodiment, in the second position, the first set of expansion elements are axially aligned with the second set of expansion elements. In an exemplary embodiment, the expansion device includes an adjustable expansion device. In an exemplary embodiment, the expansion device includes a plurality of expansion devices. In an exemplary embodiment, at least one of the expansion devices includes an adjustable expansion device. In an exemplary embodiment, the adjustable expansion device includes a support member; and a plurality of movable expansion elements coupled to the support member. In an exemplary embodiment, the apparatus further includes an actuator coupled to the support member for moving the expansion elements between a first position and a second position; wherein in the first position, the expansion elements do not engage the tubular member; and wherein in the second position, the expansion elements engage the tubular member. In an exemplary embodiment, the apparatus further includes a sensor coupled to the support member for sensing the internal diameter of the tubular member. In an exemplary embodiment, the sensor prevents the expansion elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value. In an exemplary embodiment, the expansion elements include a first set of expansion elements; and a second set of expansion elements; wherein the first set of expansion elements are interleaved with the second set of expansion elements. In an exemplary embodiment, in the first position, the first set of expansion elements are not axially aligned with the second set of expansion elements. In an exemplary embodiment, in the second position, the first set of expansion elements are axially aligned with the second set of expansion elements.

[00333] An apparatus for radially expanding and plastically deforming an expandable tubular member has been described that includes a support member; an expansion device for radially expanding and plastically deforming the tubular member coupled to the support member; and a sealing assembly for sealing an annulus defined between the support member and the tubular member. In an exemplary embodiment, the apparatus further includes a gripping device for gripping the tubular member coupled to the support member. In an exemplary embodiment, the gripping device includes a plurality of movable gripping

elements. In an exemplary embodiment, the gripping elements are moveable in a radial direction relative to the support member. In an exemplary embodiment, the gripping elements are moveable in an axial direction relative to the support member. In an exemplary embodiment, the gripping elements are moveable in a radial and an axial direction relative to the support member. In an exemplary embodiment, the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in a radial and an axial direction relative to the support member. In an exemplary embodiment, the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in a radial direction relative to the support member. In an exemplary embodiment, the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in an axial direction relative to the support member. In an exemplary embodiment, the if the tubular member is displaced in a first axial direction, the gripping device grips the tubular member; and wherein, if the tubular member is displaced in a second axial direction, the gripping device does not grip the tubular member. In an exemplary embodiment, the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, the gripping elements are biased to remain in the first position. In an exemplary embodiment, the gripping device further includes an actuator for moving the gripping elements from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein the actuator is a fluid powered actuator. In an exemplary embodiment, the apparatus further includes a locking device for locking the position of the tubular member relative to the support member. In an exemplary embodiment, the apparatus further includes a packer assembly coupled to the support member. In an exemplary embodiment, the packer assembly includes a packer; and a packer control device for controlling the operation of the packer coupled to the support member. In an exemplary embodiment, the packer includes a support member defining a passage; a shoe comprising a float valve coupled to an end of

the support member; one or more compressible packer elements movably coupled to the support member; and a sliding sleeve valve movably positioned within the passage of the support member. In an exemplary embodiment, the packer control device includes a support member; one or more drag blocks releasably coupled to the support member; and a stinger coupled to the support member for engaging the packer. In an exemplary embodiment, the packer includes a support member defining a passage; a shoe comprising a float valve coupled to an end of the support member; one or more compressible packer elements movably coupled to the support member; and a sliding sleeve valve positioned within the passage of the support member; and wherein the packer control device includes a support member; one or more drag blocks releasably coupled to the support member; and a stinger coupled to the support member for engaging the sliding sleeve valve. In an exemplary embodiment, the apparatus further includes an actuator for displacing the expansion device relative to the support member. In an exemplary embodiment, the actuator includes a first actuator for pulling the expansion device; and a second actuator for pushing the expansion device. In an exemplary embodiment, the actuator includes means for transferring torsional loads between the support member and the expansion device. In an exemplary embodiment, the first and second actuators comprise means for transferring torsional loads between the support member and the expansion device. In an exemplary embodiment, the actuator includes a plurality of pistons positioned within corresponding piston chambers. In an exemplary embodiment, the cutting device includes a support member; and a plurality of movable cutting elements coupled to the support member. In an exemplary embodiment, the apparatus further includes an actuator coupled to the support member for moving the cutting elements between a first position and a second position; wherein in the first position, the cutting elements do not engage the tubular member; and wherein in the second position, the cutting elements engage the tubular member. In an exemplary embodiment, the apparatus further includes a sensor coupled to the support member for sensing the internal diameter of the tubular member. In an exemplary embodiment, the sensor prevents the cutting elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value. In an exemplary embodiment, the cutting elements include a first set of cutting elements; and a second set of cutting elements; wherein the first set of cutting elements are interleaved with the second set of cutting elements. In an exemplary embodiment, in the first position, the first set of cutting elements are not axially aligned with the second set of cutting elements. In an exemplary embodiment, in the second position, the first set of cutting elements are axially aligned with the second set of cutting elements. In an exemplary embodiment, the expansion device includes a support member; and a plurality of movable expansion elements coupled to the support member. In an exemplary embodiment, the apparatus

further includes an actuator coupled to the support member for moving the expansion elements between a first position and a second position; wherein in the first position, the expansion elements do not engage the tubular member; and wherein in the second position, the expansion elements engage the tubular member. In an exemplary embodiment, the apparatus further includes a sensor coupled to the support member for sensing the internal diameter of the tubular member. In an exemplary embodiment, the sensor prevents the expansion elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value. In an exemplary embodiment, the expansion elements includes a first set of expansion elements; and a second set of expansion elements; wherein the first set of expansion elements are interleaved with the second set of expansion elements. In an exemplary embodiment, in the first position, the first set of expansion elements are not axially aligned with the second set of expansion elements. In an exemplary embodiment, in the second position, the first set of expansion elements are axially aligned with the second set of expansion elements. In an exemplary embodiment, the expansion device includes an adjustable expansion device. In an exemplary embodiment, the expansion device includes a plurality of expansion devices. In an exemplary embodiment, at least one of the expansion devices includes an adjustable expansion device. In an exemplary embodiment, the adjustable expansion device includes a support member; and a plurality of movable expansion elements coupled to the support member. In an exemplary embodiment, the apparatus further includes an actuator coupled to the support member for moving the expansion elements between a first position and a second position; wherein in the first position, the expansion elements do not engage the tubular member; and wherein in the second position, the expansion elements engage the tubular member. In an exemplary embodiment, the apparatus further includes a sensor coupled to the support member for sensing the internal diameter of the tubular member. In an exemplary embodiment, the sensor prevents the expansion elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value. In an exemplary embodiment, the expansion elements include a first set of expansion elements; and a second set of expansion elements; wherein the first set of expansion elements are interleaved with the second set of expansion elements. In an exemplary embodiment, in the first position, the first set of expansion elements are not axially aligned with the second set of expansion elements. In an exemplary embodiment, in the second position, the first set of expansion elements are axially aligned with the second set of expansion elements.

[00334] An apparatus for radially expanding and plastically deforming an expandable tubular member has been described that includes a support member; a first expansion device for radially expanding and plastically deforming the tubular member coupled to the

support member; and a second expansion device for radially expanding and plastically deforming the tubular member coupled to the support member. In an exemplary embodiment, the apparatus further includes a gripping device for gripping the tubular member coupled to the support member. In an exemplary embodiment, the gripping device includes a plurality of movable gripping elements. In an exemplary embodiment, the gripping elements are moveable in a radial direction relative to the support member. In an exemplary embodiment, the gripping elements are moveable in an axial direction relative to the support member. In an exemplary embodiment, the gripping elements are moveable in a radial and an axial direction relative to the support member. In an exemplary embodiment, the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in a radial and an axial direction relative to the support member. In an exemplary embodiment, the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in a radial direction relative to the support member. In an exemplary embodiment, the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in an axial direction relative to the support member. In an exemplary embodiment, if the tubular member is displaced in a first axial direction, the gripping device grips the tubular member; and wherein, if the tubular member is displaced in a second axial direction, the gripping device does not grip the tubular member. In an exemplary embodiment, the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, the gripping elements are biased to remain in the first position. In an exemplary embodiment, the gripping device further includes an actuator for moving the gripping elements from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein the actuator is a fluid powered actuator. In an exemplary embodiment, the apparatus further includes a sealing device for sealing an interface with the tubular member coupled to the support member. In an exemplary embodiment, the sealing device seals an annulus defines

between the support member and the tubular member. In an exemplary embodiment, the apparatus further includes a locking device for locking the position of the tubular member relative to the support member. In an exemplary embodiment, the apparatus further includes a packer assembly coupled to the support member. In an exemplary embodiment, the packer assembly includes a packer; and a packer control device for controlling the operation of the packer coupled to the support member. In an exemplary embodiment, the packer includes a support member defining a passage; a shoe comprising a float valve coupled to an end of the support member; one or more compressible packer elements movably coupled to the support member; and a sliding sleeve valve movably positioned within the passage of the support member. In an exemplary embodiment, the packer control device includes a support member; one or more drag blocks releasably coupled to the support member; and a stinger coupled to the support member for engaging the packer. In an exemplary embodiment, the packer includes a support member defining a passage; a shoe comprising a float valve coupled to an end of the support member; one or more compressible packer elements movably coupled to the support member; and a sliding sleeve valve positioned within the passage of the support member; and wherein the packer control device comprises: a support member; one or more drag blocks releasably coupled to the support member; and a stinger coupled to the support member for engaging the sliding sleeve valve. In an exemplary embodiment, the apparatus further includes an actuator for displacing the expansion device relative to the support member. In an exemplary embodiment, the actuator includes a first actuator for pulling the expansion device; and a second actuator for pushing the expansion device. In an exemplary embodiment, the actuator includes means for transferring torsional loads between the support member and the expansion device. In an exemplary embodiment, the first and second actuators include means for transferring torsional loads between the support member and the expansion device. In an exemplary embodiment, the actuator includes a plurality of pistons positioned within corresponding piston chambers. In an exemplary embodiment, the apparatus further includes a cutting device for cutting the tubular member coupled to the support member. In an exemplary embodiment, the cutting device includes a support member; and a plurality of movable cutting elements coupled to the support member. In an exemplary embodiment, the apparatus further includes an actuator coupled to the support member for moving the cutting elements between a first position and a second position; wherein in the first position, the cutting elements do not engage the tubular member; and wherein in the second position, the cutting elements engage the tubular member. In an exemplary embodiment, the apparatus further includes a sensor coupled to the support member for sensing the internal diameter of the tubular member. In an exemplary embodiment, the sensor prevents the cutting elements from being moved to the second position if the internal diameter of the

tubular member is less than a predetermined value. In an exemplary embodiment, the cutting elements include a first set of cutting elements; and a second set of cutting elements; wherein the first set of cutting elements are interleaved with the second set of cutting elements. In an exemplary embodiment, in the first position, the first set of cutting elements are not axially aligned with the second set of cutting elements. In an exemplary embodiment, in the second position, the first set of cutting elements are axially aligned with the second set of cutting elements. In an exemplary embodiment, at least one of the first second expansion devices include a support member; and a plurality of movable expansion elements coupled to the support member. In an exemplary embodiment, the apparatus further includes an actuator coupled to the support member for moving the expansion elements between a first position and a second position; wherein in the first position, the expansion elements do not engage the tubular member; and wherein in the second position, the expansion elements engage the tubular member. In an exemplary embodiment, the apparatus further includes a sensor coupled to the support member for sensing the internal diameter of the tubular member. In an exemplary embodiment, the sensor prevents the expansion elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value. In an exemplary embodiment, the expansion elements include a first set of expansion elements; and a second set of expansion elements; wherein the first set of expansion elements are interleaved with the second set of expansion elements. In an exemplary embodiment, in the first position, the first set of expansion elements are not axially aligned with the second set of expansion elements. In an exemplary embodiment, in the second position, the first set of expansion elements are axially aligned with the second set of expansion elements. In an exemplary embodiment, at least one of the first and second expansion devices comprise a plurality of expansion devices. In an exemplary embodiment, at least one of the first and second expansion device comprise an adjustable expansion device. In an exemplary embodiment, the adjustable expansion device includes a support member; and a plurality of movable expansion elements coupled to the support member. In an exemplary embodiment, the apparatus further includes an actuator coupled to the support member for moving the expansion elements between a first position and a second position; wherein in the first position, the expansion elements do not engage the tubular member; and wherein in the second position, the expansion elements engage the tubular member. In an exemplary embodiment, the apparatus further includes a sensor coupled to the support member for sensing the internal diameter of the tubular member. In an exemplary embodiment, the sensor prevents the expansion elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value. In an exemplary embodiment, the expansion elements include a first set of expansion elements; and a

second set of expansion elements; wherein the first set of expansion elements are interleaved with the second set of expansion elements. In an exemplary embodiment, in the first position, the first set of expansion elements are not axially aligned with the second set of expansion elements. In an exemplary embodiment, in the second position, the first set of expansion elements are axially aligned with the second set of expansion elements.

[00335] An apparatus for radially expanding and plastically deforming an expandable tubular member has been described that includes a support member; an expansion device for radially expanding and plastically deforming the tubular member coupled to the support member; and a packer coupled to the support member. In an exemplary embodiment, the apparatus further includes a gripping device for gripping the tubular member coupled to the support member. In an exemplary embodiment, the gripping device comprises a plurality of movable gripping elements. In an exemplary embodiment, the gripping elements are moveable in a radial direction relative to the support member. In an exemplary embodiment, the gripping elements are moveable in an axial direction relative to the support member. In an exemplary embodiment, the gripping elements are moveable in a radial and an axial direction relative to the support member. In an exemplary embodiment, the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in a radial and an axial direction relative to the support member. In an exemplary embodiment, the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in a radial direction relative to the support member. In an exemplary embodiment, the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in an axial direction relative to the support member. In an exemplary embodiment, if the tubular member is displaced in a first axial direction, the gripping device grips the tubular member; and wherein, if the tubular member is displaced in a second axial direction, the gripping device does not grip the tubular member. In an exemplary embodiment, the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, the gripping elements are biased to remain in the

first position. In an exemplary embodiment, the gripping device further includes an actuator for moving the gripping elements from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein the actuator is a fluid powered actuator. In an exemplary embodiment, the apparatus further includes a sealing device for sealing an interface with the tubular member coupled to the support member. In an exemplary embodiment, the sealing device seals an annulus defines between the support member and the tubular member. In an exemplary embodiment, the apparatus further includes a locking device for locking the position of the tubular member relative to the support member. In an exemplary embodiment, the packer assembly includes a packer; and a packer control device for controlling the operation of the packer coupled to the support member. In an exemplary embodiment, the packer includes a support member defining a passage; a shoe comprising a float valve coupled to an end of the support member; one or more compressible packer elements movably coupled to the support member; and a sliding sleeve valve movably positioned within the passage of the support member. In an exemplary embodiment, the packer control device includes a support member; one or more drag blocks releasably coupled to the support member; and a stinger coupled to the support member for engaging the packer. In an exemplary embodiment, the packer includes a support member defining a passage; a shoe comprising a float valve coupled to an end of the support member; one or more compressible packer elements movably coupled to the support member; and a sliding sleeve valve positioned within the passage of the support member; and wherein the packer control device includes a support member; one or more drag blocks releasably coupled to the support member; and a stinger coupled to the support member for engaging the sliding sleeve valve. In an exemplary embodiment, the apparatus further includes an actuator for displacing the expansion device relative to the support member. In an exemplary embodiment, the actuator includes a first actuator for pulling the expansion device; and a second actuator for pushing the expansion device. In an exemplary embodiment, the actuator includes means for transferring torsional loads between the support member and the expansion device. In an exemplary embodiment, the first and second actuators include means for transferring torsional loads between the support member and the expansion device. In an exemplary embodiment, the actuator includes a plurality of pistons positioned within corresponding piston chambers. In an exemplary embodiment, the apparatus further includes a cutting device coupled to the support member for cutting the tubular member. In an exemplary embodiment, the cutting device includes a support member; and a plurality of movable cutting elements coupled to the support member. In an exemplary embodiment, the apparatus further includes an actuator coupled to the support member for moving the cutting elements between a first

position and a second position; wherein in the first position, the cutting elements do not engage the tubular member; and wherein in the second position, the cutting elements engage the tubular member. In an exemplary embodiment, the apparatus further includes a sensor coupled to the support member for sensing the internal diameter of the tubular member. In an exemplary embodiment, the sensor prevents the cutting elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value. In an exemplary embodiment, the cutting elements include a first set of cutting elements; and a second set of cutting elements; wherein the first set of cutting elements are interleaved with the second set of cutting elements. In an exemplary embodiment, in the first position, the first set of cutting elements are not axially aligned with the second set of cutting elements. In an exemplary embodiment, in the second position, the first set of cutting elements are axially aligned with the second set of cutting elements. In an exemplary embodiment, the expansion device includes a support member; and a plurality of movable expansion elements coupled to the support member. In an exemplary embodiment, the apparatus further includes an actuator coupled to the support member for moving the expansion elements between a first position and a second position; wherein in the first position, the expansion elements do not engage the tubular member; and wherein in the second position, the expansion elements engage the tubular member. In an exemplary embodiment, the apparatus further includes a sensor coupled to the support member for sensing the internal diameter of the tubular member. In an exemplary embodiment, the sensor prevents the expansion elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value. In an exemplary embodiment, the expansion elements include a first set of expansion elements; and a second set of expansion elements; wherein the first set of expansion elements are interleaved with the second set of expansion elements. In an exemplary embodiment, in the first position, the first set of expansion elements are not axially aligned with the second set of expansion elements. In an exemplary embodiment, in the second position, the first set of expansion elements are axially aligned with the second set of expansion elements. In an exemplary embodiment, the expansion device includes an adjustable expansion device. In an exemplary embodiment, the expansion device includes a plurality of expansion devices. In an exemplary embodiment, at least one of the expansion devices comprises an adjustable expansion device. In an exemplary embodiment, the adjustable expansion device includes a support member; and a plurality of movable expansion elements coupled to the support member. In an exemplary embodiment, the apparatus further includes an actuator coupled to the support member for moving the expansion elements between a first position and a second position; wherein in the first position, the expansion elements do not engage the tubular member; and wherein in the second position, the expansion elements engage the

tubular member. In an exemplary embodiment, the apparatus further includes a sensor coupled to the support member for sensing the internal diameter of the tubular member. In an exemplary embodiment, the sensor prevents the expansion elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value. In an exemplary embodiment, the expansion elements include a first set of expansion elements; and a second set of expansion elements; wherein the first set of expansion elements are interleaved with the second set of expansion elements. In an exemplary embodiment, in the first position, the first set of expansion elements are not axially aligned with the second set of expansion elements. In an exemplary embodiment, in the second position, the first set of expansion elements are axially aligned with the second set of expansion elements.

[00336] An apparatus for radially expanding and plastically deforming an expandable tubular member has been described that includes a support member; a cutting device for cutting the tubular member coupled to the support member; a gripping device for gripping the tubular member coupled to the support member; a sealing device for sealing an interface with the tubular member coupled to the support member; a locking device for locking the position of the tubular member relative to the support member; a first adjustable expansion device for radially expanding and plastically deforming the tubular member coupled to the support member; a second adjustable expansion device for radially expanding and plastically deforming the tubular member coupled to the support member; a packer coupled to the support member; and an actuator for displacing one or more of the sealing assembly, first and second adjustable expansion devices, and packer relative to the support member. In an exemplary embodiment, the gripping device includes a plurality of movable gripping elements. In an exemplary embodiment, the gripping elements are moveable in a radial direction relative to the support member. In an exemplary embodiment, the gripping elements are moveable in an axial direction relative to the support member. In an exemplary embodiment, the gripping elements are moveable in a radial and an axial direction relative to the support member. In an exemplary embodiment, the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in a radial and an axial direction relative to the support member. In an exemplary embodiment, the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in a radial direction relative to the support

member. In an exemplary embodiment, the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in an axial direction relative to the support member. In an exemplary embodiment, if the tubular member is displaced in a first axial direction, the gripping device grips the tubular member; and wherein, if the tubular member is displaced in a second axial direction, the gripping device does not grip the tubular member. In an exemplary embodiment, the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, the gripping elements are biased to remain in the first position. In an exemplary embodiment, the gripping device further includes an actuator for moving the gripping elements from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein the actuator is a fluid powered actuator. In an exemplary embodiment, the sealing device seals an annulus defines between the support member and the tubular member. In an exemplary embodiment, the packer assembly includes a packer; and a packer control device for controlling the operation of the packer coupled to the support member. In an exemplary embodiment, the packer includes a support member defining a passage; a shoe comprising a float valve coupled to an end of the support member; one or more compressible packer elements movably coupled to the support member; and a sliding sleeve valve movably positioned within the passage of the support member. In an exemplary embodiment, the packer control device includes a support member; one or more drag blocks releasably coupled to the support member; and a stinger coupled to the support member for engaging the packer. In an exemplary embodiment, the packer includes a support member defining a passage; a shoe comprising a float valve coupled to an end of the support member; one or more compressible packer elements movably coupled to the support member; and a sliding sleeve valve positioned within the passage of the support member; and wherein the packer control device includes a support member; one or more drag blocks releasably coupled to the support member; and a stinger coupled to the support member for engaging the sliding sleeve valve. In an exemplary embodiment, the actuator includes a first actuator for pulling the expansion device; and a second actuator for pushing the expansion device. In an exemplary embodiment, the actuator includes means for transferring torsional loads between the support member and the expansion device. In an exemplary embodiment, the first and second actuators include means for transferring torsional loads between the support

member and the expansion device. In an exemplary embodiment, the actuator includes a plurality of pistons positioned within corresponding piston chambers. In an exemplary embodiment, the cutting device includes a support member; and a plurality of movable cutting elements coupled to the support member. In an exemplary embodiment, the apparatus further includes an actuator coupled to the support member for moving the cutting elements between a first position and a second position; wherein in the first position, the cutting elements do not engage the tubular member; and wherein in the second position, the cutting elements engage the tubular member. In an exemplary embodiment, the apparatus further includes a sensor coupled to the support member for sensing the internal diameter of the tubular member. In an exemplary embodiment, the sensor prevents the cutting elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value. In an exemplary embodiment, the cutting elements include a first set of cutting elements; and a second set of cutting elements; wherein the first set of cutting elements are interleaved with the second set of cutting elements. In an exemplary embodiment, in the first position, the first set of cutting elements are not axially aligned with the second set of cutting elements. In an exemplary embodiment, in the second position, the first set of cutting elements are axially aligned with the second set of cutting elements. In an exemplary embodiment, at least one of the adjustable expansion devices include a support member; and a plurality of movable expansion elements coupled to the support member. In an exemplary embodiment, the apparatus further includes an actuator coupled to the support member for moving the expansion elements between a first position and a second position; wherein in the first position, the expansion elements do not engage the tubular member; and wherein in the second position, the expansion elements engage the tubular member. In an exemplary embodiment, the apparatus further includes a sensor coupled to the support member for sensing the internal diameter of the tubular member. In an exemplary embodiment, the sensor prevents the expansion elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value. In an exemplary embodiment, the expansion elements include a first set of expansion elements; and a second set of expansion elements; wherein the first set of expansion elements are interleaved with the second set of expansion elements. In an exemplary embodiment, in the first position, the first set of expansion elements are not axially aligned with the second set of expansion elements. In an exemplary embodiment, in the second position, the first set of expansion elements are axially aligned with the second set of expansion elements. In an exemplary embodiment, at least one of the adjustable expansion devices comprise a plurality of expansion devices. In an exemplary embodiment, at least one of the adjustable expansion devices include a support member; and a plurality of movable expansion elements coupled to the support member. In an exemplary

embodiment, the apparatus further includes an actuator coupled to the support member for moving the expansion elements between a first position and a second position; wherein in the first position, the expansion elements do not engage the tubular member; and wherein in the second position, the expansion elements engage the tubular member. In an exemplary embodiment, the apparatus further includes a sensor coupled to the support member for sensing the internal diameter of the tubular member. In an exemplary embodiment, the sensor prevents the expansion elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value. In an exemplary embodiment, the expansion elements include a first set of expansion elements; and a second set of expansion elements; wherein the first set of expansion elements are interleaved with the second set of expansion elements. In an exemplary embodiment, in the first position, the first set of expansion elements are not axially aligned with the second set of expansion elements. In an exemplary embodiment, in the second position, the first set of expansion elements are axially aligned with the second set of expansion elements.

[00337] An apparatus for cutting a tubular member has been described that includes a support member; and a plurality of movable cutting elements coupled to the support member. In an exemplary embodiment, the apparatus further includes an actuator coupled to the support member for moving the cutting elements between a first position and a second position; wherein in the first position, the cutting elements do not engage the tubular member; and wherein in the second position, the cutting elements engage the tubular member. In an exemplary embodiment, the apparatus further includes a sensor coupled to the support member for sensing the internal diameter of the tubular member. In an exemplary embodiment, the sensor prevents the cutting elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value. In an exemplary embodiment, the cutting elements include a first set of cutting elements; and a second set of cutting elements; wherein the first set of cutting elements are interleaved with the second set of cutting elements. In an exemplary embodiment, in the first position, the first set of cutting elements are not axially aligned with the second set of cutting elements. In an exemplary embodiment, in the second position, the first set of cutting elements are axially aligned with the second set of cutting elements.

[00338] An apparatus for engaging a tubular member has been described that includes a support member; and a plurality of movable elements coupled to the support member. In an exemplary embodiment, the apparatus further includes an actuator coupled to the support member for moving the elements between a first position and a second position; wherein in the first position, the elements do not engage the tubular member; and wherein in the second position, the elements engage the tubular member. In an exemplary embodiment, the apparatus further includes a sensor coupled to the support member for

sensing the internal diameter of the tubular member. In an exemplary embodiment, the sensor prevents the elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value. In an exemplary embodiment, the elements include a first set of elements; and a second set of elements; wherein the first set of elements are interleaved with the second set of elements. In an exemplary embodiment, in the first position, the first set of elements are not axially aligned with the second set of elements. In an exemplary embodiment, in the second position, the first set of elements are axially aligned with the second set of elements.

[00339] An apparatus for gripping a tubular member has been described that includes a plurality of movable gripping elements. In an exemplary embodiment, the gripping elements are moveable in a radial direction. In an exemplary embodiment, the gripping elements are moveable in an axial direction. In an exemplary embodiment, the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in a radial and an axial direction. In an exemplary embodiment, the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in a radial direction. In an exemplary embodiment, the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in an axial direction. In an exemplary embodiment, in a first axial direction, the gripping device grips the tubular member; and wherein, in a second axial direction, the gripping device does not grip the tubular member. In an exemplary embodiment, the apparatus further includes an actuator for moving the gripping elements. In an exemplary embodiment, the gripping elements include a plurality of separate and distinct gripping elements.

[00340] An actuator has been described that includes a tubular housing; a tubular piston rod movably coupled to and at least partially positioned within the housing; a plurality of annular piston chambers defined by the tubular housing and the tubular piston rod; and a plurality of tubular pistons coupled to the tubular piston rod, each tubular piston movably positioned within a corresponding annular piston chamber. In an exemplary embodiment, the actuator further includes means for transmitting torsional loads between the tubular

housing and the tubular piston rod.

[00341] An apparatus for controlling a packer has been described that includes a tubular support member; one or more drag blocks releasably coupled to the tubular support member; and a tubular stinger coupled to the tubular support member for engaging the packer. In an exemplary embodiment, the apparatus further includes a tubular sleeve coupled to the drag blocks. In an exemplary embodiment, the tubular support member includes one or more axially aligned teeth for engaging the packer.

[00342] A packer has been described that includes a support member defining a passage; a shoe comprising a float valve coupled to an end of the support member; one or more compressible packer elements movably coupled to the support member; and a sliding sleeve valve movably positioned within the passage of the support member.

[00343] A method of radially expanding and plastically deforming an expandable tubular member within a borehole having a preexisting wellbore casing has been described that includes positioning the tubular member within the borehole in overlapping relation to the wellbore casing; radially expanding and plastically deforming a portion of the tubular member to form a bell section; and radially expanding and plastically deforming a portion of the tubular member above the bell section comprising a portion of the tubular member that overlaps with the wellbore casing; wherein the inside diameter of the bell section is greater than the inside diameter of the radially expanded and plastically deformed portion of the tubular member above the bell section. In an exemplary embodiment, radially expanding and plastically deforming a portion of the tubular member to form a bell section includes positioning an adjustable expansion device within the expandable tubular member; supporting the expandable tubular member and the adjustable expansion device within the borehole; lowering the adjustable expansion device out of the expandable tubular member; increasing the outside dimension of the adjustable expansion device; and displacing the adjustable expansion device upwardly relative to the expandable tubular member n times to radially expand and plastically deform n portions of the expandable tubular member, wherein n is greater than or equal to 1.

[00344] A method for forming a mono diameter wellbore casing has been described that includes positioning an adjustable expansion device within a first expandable tubular member; supporting the first expandable tubular member and the adjustable expansion device within a borehole; lowering the adjustable expansion device out of the first expandable tubular member; increasing the outside dimension of the adjustable expansion device; displacing the adjustable expansion device upwardly relative to the first expandable tubular member m times to radially expand and plastically deform m portions of the first expandable tubular member within the borehole; positioning the adjustable expansion device within a second expandable tubular member; supporting the second expandable tubular

member and the adjustable expansion device within the borehole in overlapping relation to the first expandable tubular member; lowering the adjustable expansion device out of the second expandable tubular member; increasing the outside dimension of the adjustable expansion device; and displacing the adjustable expansion device upwardly relative to the second expandable tubular member n times to radially expand and plastically deform n portions of the second expandable tubular member within the borehole.

[00345] A method for radially expanding and plastically deforming an expandable tubular member within a borehole has been described that includes positioning an adjustable expansion device within the expandable tubular member; supporting the expandable tubular member and the adjustable expansion device within the borehole; lowering the adjustable expansion device out of the expandable tubular member; increasing the outside dimension of the adjustable expansion device; displacing the adjustable expansion mandrel upwardly relative to the expandable tubular member n times to radially expand and plastically deform n portions of the expandable tubular member within the borehole; and pressurizing an interior region of the expandable tubular member above the adjustable expansion device during the radial expansion and plastic deformation of the expandable tubular member within the borehole.

[00346] A method for forming a mono diameter wellbore casing has been described that includes positioning an adjustable expansion device within a first expandable tubular member; supporting the first expandable tubular member and the adjustable expansion device within a borehole; lowering the adjustable expansion device out of the first expandable tubular member; increasing the outside dimension of the adjustable expansion device; displacing the adjustable expansion device upwardly relative to the first expandable tubular member m times to radially expand and plastically deform m portions of the first expandable tubular member within the borehole; pressurizing an interior region of the first expandable tubular member above the adjustable expansion device during the radial expansion and plastic deformation of the first expandable tubular member within the borehole; positioning the adjustable expansion mandrel within a second expandable tubular member; supporting the second expandable tubular member and the adjustable expansion mandrel within the borehole in overlapping relation to the first expandable tubular member; lowering the adjustable expansion mandrel out of the second expandable tubular member; increasing the outside dimension of the adjustable expansion mandrel; displacing the adjustable expansion mandrel upwardly relative to the second expandable tubular member n times to radially expand and plastically deform n portions of the second expandable tubular member within the borehole; and pressurizing an interior region of the second expandable tubular member above the adjustable expansion mandrel during the radial expansion and plastic deformation of the second expandable tubular member within the borehole.

[00347] A method for radially expanding and plastically deforming an expandable tubular member within a borehole has been described that includes positioning first and second adjustable expansion devices within the expandable tubular member; supporting the expandable tubular member and the first and second adjustable expansion devices within the borehole; lowering the first adjustable expansion device out of the expandable tubular member; increasing the outside dimension of the first adjustable expansion device; displacing the first adjustable expansion device upwardly relative to the expandable tubular member to radially expand and plastically deform a lower portion of the expandable tubular member; displacing the first adjustable expansion device and the second adjustable expansion device downwardly relative to the expandable tubular member; decreasing the outside dimension of the first adjustable expansion device and increasing the outside dimension of the second adjustable expansion device; displacing the second adjustable expansion device upwardly relative to the expandable tubular member to radially expand and plastically deform portions of the expandable tubular member above the lower portion of the expandable tubular member; wherein the outside dimension of the first adjustable expansion device is greater than the outside dimension of the second adjustable expansion device.

[00348] A method for forming a mono diameter wellbore casing has been described that includes positioning first and second adjustable expansion devices within a first expandable tubular member; supporting the first expandable tubular member and the first and second adjustable expansion devices within a borehole; lowering the first adjustable expansion device out of the first expandable tubular member; increasing the outside dimension of the first adjustable expansion device; displacing the first adjustable expansion device upwardly relative to the first expandable tubular member to radially expand and plastically deform a lower portion of the first expandable tubular member; displacing the first adjustable expansion device and the second adjustable expansion device downwardly relative to the first expandable tubular member; decreasing the outside dimension of the first adjustable expansion device and increasing the outside dimension of the second adjustable expansion device; displacing the second adjustable expansion device upwardly relative to the first expandable tubular member to radially expand and plastically deform portions of the first expandable tubular member above the lower portion of the expandable tubular member; positioning first and second adjustable expansion devices within a second expandable tubular member; supporting the first expandable tubular member and the first and second adjustable expansion devices within the borehole in overlapping relation to the first expandable tubular member; lowering the first adjustable expansion device out of the second expandable tubular member; increasing the outside dimension of the first adjustable expansion device; displacing the first adjustable expansion device upwardly relative to the

second expandable tubular member to radially expand and plastically deform a lower portion of the second expandable tubular member; displacing the first adjustable expansion device and the second adjustable expansion device downwardly relative to the second expandable tubular member; decreasing the outside dimension of the first adjustable expansion device and increasing the outside dimension of the second adjustable expansion device; and displacing the second adjustable expansion device upwardly relative to the second expandable tubular member to radially expand and plastically deform portions of the second expandable tubular member above the lower portion of the second expandable tubular member; wherein the outside dimension of the first adjustable expansion device is greater than the outside dimension of the second adjustable expansion device.

[00349] A method for radially expanding and plastically deforming an expandable tubular member within a borehole has been described that includes positioning first and second adjustable expansion devices within the expandable tubular member; supporting the expandable tubular member and the first and second adjustable expansion devices within the borehole; lowering the first adjustable expansion device out of the expandable tubular member; increasing the outside dimension of the first adjustable expansion device; displacing the first adjustable expansion device upwardly relative to the expandable tubular member to radially expand and plastically deform a lower portion of the expandable tubular member; pressurizing an interior region of the expandable tubular member above the first adjustable expansion device during the radial expansion of the lower portion of the expandable tubular member by the first adjustable expansion device; displacing the first adjustable expansion device and the second adjustable expansion device downwardly relative to the expandable tubular member; decreasing the outside dimension of the first adjustable expansion device and increasing the outside dimension of the second adjustable expansion device; displacing the second adjustable expansion device upwardly relative to the expandable tubular member to radially expand and plastically deform portions of the expandable tubular member above the lower portion of the expandable tubular member; and pressurizing an interior region of the expandable tubular member above the second adjustable expansion device during the radial expansion of the portions of the expandable tubular member above the lower portion of the expandable tubular member by the second adjustable expansion device; wherein the outside dimension of the first adjustable expansion device is greater than the outside dimension of the second adjustable expansion device.

[00350] A method for forming a mono diameter wellbore casing has been described that includes positioning first and second adjustable expansion devices within a first expandable tubular member; supporting the first expandable tubular member and the first and second adjustable expansion devices within a borehole; lowering the first adjustable expansion device out of the first expandable tubular member; increasing the outside

dimension of the first adjustable expansion device; displacing the first adjustable expansion device upwardly relative to the first expandable tubular member to radially expand and plastically deform a lower portion of the first expandable tubular member; pressurizing an interior region of the first expandable tubular member above the first adjustable expansion device during the radial expansion of the lower portion of the first expandable tubular member by the first adjustable expansion device; displacing the first adjustable expansion device and the second adjustable expansion device downwardly relative to the first expandable tubular member; decreasing the outside dimension of the first adjustable expansion device and increasing the outside dimension of the second adjustable expansion device; displacing the second adjustable expansion device upwardly relative to the first expandable tubular member to radially expand and plastically deform portions of the first expandable tubular member above the lower portion of the expandable tubular member; pressurizing an interior region of the first expandable tubular member above the second adjustable expansion device during the radial expansion of the portions of the first expandable tubular member above the lower portion of the first expandable tubular member by the second adjustable expansion device; positioning first and second adjustable expansion devices within a second expandable tubular member; supporting the first expandable tubular member and the first and second adjustable expansion devices within the borehole in overlapping relation to the first expandable tubular member; lowering the first adjustable expansion device out of the second expandable tubular member; increasing the outside dimension of the first adjustable expansion device; displacing the first adjustable expansion device upwardly relative to the second expandable tubular member to radially expand and plastically deform a lower portion of the second expandable tubular member; pressurizing an interior region of the second expandable tubular member above the first adjustable expansion device during the radial expansion of the lower portion of the second expandable tubular member by the first adjustable expansion device; displacing the first adjustable expansion device and the second adjustable expansion device downwardly relative to the second expandable tubular member; decreasing the outside dimension of the first adjustable expansion device and increasing the outside dimension of the second adjustable expansion device; displacing the second adjustable expansion device upwardly relative to the second expandable tubular member to radially expand and plastically deform portions of the second expandable tubular member above the lower portion of the second expandable tubular member; and pressurizing an interior region of the second expandable tubular member above the second adjustable expansion device during the radial expansion of the portions of the second expandable tubular member above the lower portion of the second expandable tubular member by the second adjustable expansion device; wherein the outside dimension of the first adjustable expansion device is greater than the outside

dimension of the second adjustable expansion device.

[00351] A method for radially expanding and plastically deforming an expandable tubular member within a borehole has been described that includes supporting the expandable tubular member, an hydraulic actuator, and an adjustable expansion device within the borehole; increasing the size of the adjustable expansion device; and displacing the adjustable expansion device upwardly relative to the expandable tubular member using the hydraulic actuator to radially expand and plastically deform a portion of the expandable tubular member. In an exemplary embodiment, the method further includes reducing the size of the adjustable expansion device after the portion of the expandable tubular member has been radially expanded and plastically deformed. In an exemplary embodiment, the method further includes fluidicly sealing the radially expanded and plastically deformed end of the expandable tubular member after reducing the size of the adjustable expansion device. In an exemplary embodiment, the method further includes permitting the position of the expandable tubular member to float relative to the position of the hydraulic actuator after fluidicly sealing the radially expanded and plastically deformed end of the expandable tubular member. In an exemplary embodiment, the method further includes injecting a hardenable fluidic sealing material into an annulus between the expandable tubular member and a preexisting structure after permitting the position of the expandable tubular member to float relative to the position of the hydraulic actuator. In an exemplary embodiment, the method further includes increasing the size of the adjustable expansion device after permitting the position of the expandable tubular member to float relative to the position of the hydraulic actuator. In an exemplary embodiment, the method further includes displacing the adjustable expansion cone upwardly relative to the expandable tubular member to radially expand and plastically deform another portion of the expandable tubular member. In an exemplary embodiment, the method further includes if the end of the other portion of the expandable tubular member overlaps with a preexisting structure, then not permitting the position of the expandable tubular member to float relative to the position of the hydraulic actuator; and displacing the adjustable expansion cone upwardly relative to the expandable tubular member using the hydraulic actuator to radially expand and plastically deform the end of the other portion of the expandable tubular member that overlaps with the preexisting structure.

[00352] A method for forming a mono diameter wellbore casing within a borehole that includes a preexisting wellbore casing has been described that includes supporting the expandable tubular member, an hydraulic actuator, and an adjustable expansion device within the borehole; increasing the size of the adjustable expansion device; displacing the adjustable expansion device upwardly relative to the expandable tubular member using the hydraulic actuator to radially expand and plastically deform a portion of the expandable

tubular member; and displacing the adjustable expansion device upwardly relative to the expandable tubular member to radially expand and plastically deform the remaining portion of the expandable tubular member and a portion of the preexisting wellbore casing that overlaps with an end of the remaining portion of the expandable tubular member. In an exemplary embodiment, the method further includes reducing the size of the adjustable expansion device after the portion of the expandable tubular member has been radially expanded and plastically deformed. In an exemplary embodiment, the method further includes fluidicly sealing the radially expanded and plastically deformed end of the expandable tubular member after reducing the size of the adjustable expansion device. In an exemplary embodiment, the method further includes permitting the position of the expandable tubular member to float relative to the position of the hydraulic actuator after fluidicly sealing the radially expanded and plastically deformed end of the expandable tubular member. In an exemplary embodiment, the method further includes injecting a hardenable fluidic sealing material into an annulus between the expandable tubular member and the borehole after permitting the position of the expandable tubular member to float relative to the position of the hydraulic actuator. In an exemplary embodiment, the method further includes increasing the size of the adjustable expansion device after permitting the position of the expandable tubular member to float relative to the position of the hydraulic actuator. In an exemplary embodiment, the method further includes displacing the adjustable expansion cone upwardly relative to the expandable tubular member to radially expand and plastically deform the remaining portion of the expandable tubular member. In an exemplary embodiment, the method further includes not permitting the position of the expandable tubular member to float relative to the position of the hydraulic actuator; and displacing the adjustable expansion cone upwardly relative to the expandable tubular member using the hydraulic actuator to radially expand and plastically deform the end of the remaining portion of the expandable tubular member that overlaps with the preexisting wellbore casing after not permitting the position of the expandable tubular member to float relative to the position of the hydraulic actuator.

[00353] A method of radially expanding and plastically deforming a tubular member has been described that includes positioning the tubular member within a preexisting structure; radially expanding and plastically deforming a lower portion of the tubular member to form a bell section; and radially expanding and plastically deforming a portion of the tubular member above the bell section. In an exemplary embodiment, positioning the tubular member within a preexisting structure includes locking the tubular member to an expansion device. In an exemplary embodiment, the outside diameter of the expansion device is less than the inside diameter of the tubular member. In an exemplary embodiment, the expansion device is positioned within the tubular member. In an exemplary embodiment, the

expansion device includes an adjustable expansion device. In an exemplary embodiment, the adjustable expansion device is adjustable to a plurality of sizes. In an exemplary embodiment, the expansion device includes a plurality of expansion devices. In an exemplary embodiment, at least one of the expansion devices includes an adjustable expansion device. In an exemplary embodiment, at least one of the adjustable expansion device is adjustable to a plurality of sizes. In an exemplary embodiment, radially expanding and plastically deforming a lower portion of the tubular member to form a bell section includes lowering an expansion device out of an end of the tubular member; and pulling the expansion device through the end of the tubular member. In an exemplary embodiment, lowering an expansion device out of an end of the tubular member includes lowering the expansion device out of the end of the tubular member; and adjusting the size of the expansion device. In an exemplary embodiment, the adjustable expansion device is adjustable to a plurality of sizes. In an exemplary embodiment, the expansion device includes a plurality of adjustable expansion devices. In an exemplary embodiment, at least one of the adjustable expansion devices is adjustable to a plurality of sizes. In an exemplary embodiment, pulling the expansion device through the end of the tubular member includes gripping the tubular member; and pulling an expansion device through an end of the tubular member. In an exemplary embodiment, gripping the tubular member includes permitting axial displacement of the tubular member in a first direction; and not permitting axial displacement of the tubular member in a second direction. In an exemplary embodiment, pulling the expansion device through the end of the tubular member includes pulling the expansion device through the end of the tubular member using an actuator. In an exemplary embodiment, radially expanding and plastically deforming a portion of the tubular member above the bell section includes lowering an expansion device out of an end of the tubular member; and pulling the expansion device through the end of the tubular member. In an exemplary embodiment, lowering an expansion device out of an end of the tubular member includes lowering the expansion device out of the end of the tubular member; and adjusting the size of the expansion device. In an exemplary embodiment, the adjustable expansion device is adjustable to a plurality of sizes. In an exemplary embodiment, the expansion device includes a plurality of adjustable expansion devices. In an exemplary embodiment, at least one of the adjustable expansion devices is adjustable to a plurality of sizes. In an exemplary embodiment, pulling the expansion device through the end of the tubular member includes gripping the tubular member; and pulling an expansion device through an end of the tubular member. In an exemplary embodiment, gripping the tubular member includes permitting axial displacement of the tubular member in a first direction; and not permitting axial displacement of the tubular member in a second direction. In an exemplary embodiment, pulling the expansion device through the end of the tubular member includes

pulling the expansion device through the end of the tubular member using an actuator. In an exemplary embodiment, pulling the expansion device through the end of the tubular member includes pulling the expansion device through the end of the tubular member using fluid pressure. In an exemplary embodiment, pulling the expansion device through the end of the tubular member using fluid pressure includes pressurizing an annulus within the tubular member above the expansion device. In an exemplary embodiment, radially expanding and plastically deforming a portion of the tubular member above the bell section includes fluidicly sealing an end of the tubular member; and pulling the expansion device through the tubular member. In an exemplary embodiment, the expansion device is adjustable. In an exemplary embodiment, the expansion device is adjustable to a plurality of sizes. In an exemplary embodiment, the expansion device comprises a plurality of adjustable expansion devices. In an exemplary embodiment, at least one of the adjustable expansion devices is adjustable to a plurality of sizes. In an exemplary embodiment, pulling the expansion device through the end of the tubular member includes gripping the tubular member; and pulling an expansion device through an end of the tubular member. In an exemplary embodiment, gripping the tubular member includes permitting axial displacement of the tubular member in a first direction; and not permitting axial displacement of the tubular member in a second direction. In an exemplary embodiment, pulling the expansion device through the end of the tubular member includes pulling the expansion device through the end of the tubular member using an actuator. In an exemplary embodiment, pulling the expansion device through the end of the tubular member includes pulling the expansion device through the end of the tubular member using fluid pressure. In an exemplary embodiment, pulling the expansion device through the end of the tubular member using fluid pressure includes pressurizing an annulus within the tubular member above the expansion device. In an exemplary embodiment, radially expanding and plastically deforming a portion of the tubular member above the bell section includes overlapping the portion of the tubular member above the bell section with an end of a preexisting tubular member; and pulling an expansion device through the overlapping portions of the tubular member and the preexisting tubular member. In an exemplary embodiment, the expansion device is adjustable. In an exemplary embodiment, the expansion device is adjustable to a plurality of sizes. In an exemplary embodiment, the expansion device includes a plurality of adjustable expansion devices. In an exemplary embodiment, at least one of the adjustable expansion devices is adjustable to a plurality of sizes. In an exemplary embodiment, pulling the expansion device through the overlapping portions of the tubular member and the preexisting tubular member includes gripping the tubular member; and pulling the expansion device through the overlapping portions of the tubular member and the preexisting tubular member. In an exemplary embodiment, gripping the tubular member includes permitting axial displacement

of the tubular member in a first direction; and not permitting axial displacement of the tubular member in a second direction. In an exemplary embodiment, pulling the expansion device through the overlapping portions of the tubular member and the preexisting tubular member includes pulling the expansion device through the overlapping portions of the tubular member and the preexisting tubular member using an actuator. In an exemplary embodiment, pulling the expansion device through the overlapping portions of the tubular member and the preexisting tubular member includes pulling the expansion device through the overlapping portions of the tubular member and the preexisting tubular member using fluid pressure. In an exemplary embodiment, pulling the expansion device through the overlapping portions of the tubular member and the preexisting tubular member using fluid pressure includes pressurizing an annulus within the tubular member above the expansion device. In an exemplary embodiment, the method further includes cutting an end of the portion of the tubular member that overlaps with the preexisting tubular member. In an exemplary embodiment, the method further includes removing the cut off end of the expandable tubular member from the preexisting structure. In an exemplary embodiment, the method further includes injecting a hardenable fluidic sealing material into an annulus between the expandable tubular member and the preexisting structure. In an exemplary embodiment, the method further includes cutting off an end of the expandable tubular member. In an exemplary embodiment, the method further includes removing the cut off end of the expandable tubular member from the preexisting structure.

[00354] A method of radially expanding and plastically deforming a tubular member has been described that includes applying internal pressure to the inside surface of the tubular member at a plurality of discrete location separated from one another.

[00355] A system for radially expanding and plastically deforming an expandable tubular member within a borehole having a preexisting wellbore casing has been described that includes means for positioning the tubular member within the borehole in overlapping relation to the wellbore casing; means for radially expanding and plastically deforming a portion of the tubular member to form a bell section; and means for radially expanding and plastically deforming a portion of the tubular member above the bell section comprising a portion of the tubular member that overlaps with the wellbore casing; wherein the inside diameter of the bell section is greater than the inside diameter of the radially expanded and plastically deformed portion of the tubular member above the bell section. In an exemplary embodiment, means for radially expanding and plastically deforming a portion of the tubular member to form a bell section includes means for positioning an adjustable expansion device within the expandable tubular member; means for supporting the expandable tubular member and the adjustable expansion device within the borehole; means for lowering the adjustable expansion device out of the expandable tubular member; means for increasing

the outside dimension of the adjustable expansion device; and means for displacing the adjustable expansion device upwardly relative to the expandable tubular member n times to radially expand and plastically deform n portions of the expandable tubular member, wherein n is greater than or equal to 1.

[00356] A system for forming a mono diameter wellbore casing has been described that includes means for positioning an adjustable expansion device within a first expandable tubular member; means for supporting the first expandable tubular member and the adjustable expansion device within a borehole; means for lowering the adjustable expansion device out of the first expandable tubular member; means for increasing the outside dimension of the adjustable expansion device; means for displacing the adjustable expansion device upwardly relative to the first expandable tubular member m times to radially expand and plastically deform m portions of the first expandable tubular member within the borehole; means for positioning the adjustable expansion device within a second expandable tubular member; means for supporting the second expandable tubular member and the adjustable expansion device within the borehole in overlapping relation to the first expandable tubular member; means for lowering the adjustable expansion device out of the second expandable tubular member; means for increasing the outside dimension of the adjustable expansion device; and means for displacing the adjustable expansion device upwardly relative to the second expandable tubular member n times to radially expand and plastically deform n portions of the second expandable tubular member within the borehole.

[00357] A system for radially expanding and plastically deforming an expandable tubular member within a borehole has been described that includes means for positioning an adjustable expansion device within the expandable tubular member; means for supporting the expandable tubular member and the adjustable expansion device within the borehole; means for lowering the adjustable expansion device out of the expandable tubular member; means for increasing the outside dimension of the adjustable expansion device; means for displacing the adjustable expansion mandrel upwardly relative to the expandable tubular member n times to radially expand and plastically deform n portions of the expandable tubular member within the borehole; and means for pressurizing an interior region of the expandable tubular member above the adjustable expansion device during the radial expansion and plastic deformation of the expandable tubular member within the borehole.

[00358] A system for forming a mono diameter wellbore casing has been described that includes means for positioning an adjustable expansion device within a first expandable tubular member; means for supporting the first expandable tubular member and the adjustable expansion device within a borehole; means for lowering the adjustable expansion device out of the first expandable tubular member; means for increasing the outside dimension of the adjustable expansion device; means for displacing the adjustable

expansion device upwardly relative to the first expandable tubular member m times to radially expand and plastically deform m portions of the first expandable tubular member within the borehole; means for pressurizing an interior region of the first expandable tubular member above the adjustable expansion device during the radial expansion and plastic deformation of the first expandable tubular member within the borehole; means for positioning the adjustable expansion mandrel within a second expandable tubular member; means for supporting the second expandable tubular member and the adjustable expansion mandrel within the borehole in overlapping relation to the first expandable tubular member; means for lowering the adjustable expansion mandrel out of the second expandable tubular member; means for increasing the outside dimension of the adjustable expansion mandrel; means for displacing the adjustable expansion mandrel upwardly relative to the second expandable tubular member n times to radially expand and plastically deform n portions of the second expandable tubular member within the borehole; and means for pressurizing an interior region of the second expandable tubular member above the adjustable expansion mandrel during the radial expansion and plastic deformation of the second expandable tubular member within the borehole.

[00359] A system for radially expanding and plastically deforming an expandable tubular member within a borehole has been described that includes means for positioning first and second adjustable expansion devices within the expandable tubular member; means for supporting the expandable tubular member and the first and second adjustable expansion devices within the borehole; means for lowering the first adjustable expansion device out of the expandable tubular member; means for increasing the outside dimension of the first adjustable expansion device; means for displacing the first adjustable expansion device upwardly relative to the expandable tubular member to radially expand and plastically deform a lower portion of the expandable tubular member; means for displacing the first adjustable expansion device and the second adjustable expansion device downwardly relative to the expandable tubular member; means for decreasing the outside dimension of the first adjustable expansion device and increasing the outside dimension of the second adjustable expansion device; means for displacing the second adjustable expansion device upwardly relative to the expandable tubular member to radially expand and plastically deform portions of the expandable tubular member above the lower portion of the expandable tubular member; wherein the outside dimension of the first adjustable expansion device is greater than the outside dimension of the second adjustable expansion device.

[00360] A system for forming a mono diameter wellbore casing has been described that includes means for positioning first and second adjustable expansion devices within a first expandable tubular member; means for supporting the first expandable tubular member and the first and second adjustable expansion devices within a borehole; means for lowering

the first adjustable expansion device out of the first expandable tubular member; means for increasing the outside dimension of the first adjustable expansion device; displacing the first adjustable expansion device upwardly relative to the first expandable tubular member to radially expand and plastically deform a lower portion of the first expandable tubular member; means for displacing the first adjustable expansion device and the second adjustable expansion device downwardly relative to the first expandable tubular member; means for decreasing the outside dimension of the first adjustable expansion device and increasing the outside dimension of the second adjustable expansion device; means for displacing the second adjustable expansion device upwardly relative to the first expandable tubular member to radially expand and plastically deform portions of the first expandable tubular member above the lower portion of the expandable tubular member; means for positioning first and second adjustable expansion devices within a second expandable tubular member; means for supporting the first expandable tubular member and the first and second adjustable expansion devices within the borehole in overlapping relation to the first expandable tubular member; means for lowering the first adjustable expansion device out of the second expandable tubular member; means for increasing the outside dimension of the first adjustable expansion device; means for displacing the adjustable expansion device upwardly relative to the second expandable tubular member to radially expand and plastically deform a lower portion of the second expandable tubular member; means for displacing the first adjustable expansion device and the second adjustable expansion device downwardly relative to the second expandable tubular member; means for decreasing the outside dimension of the first adjustable expansion device and increasing the outside dimension of the second adjustable expansion device; and means for displacing the second adjustable expansion device upwardly relative to the second expandable tubular member to radially expand and plastically deform portions of the second expandable tubular member above the lower portion of the second expandable tubular member; wherein the outside dimension of the first adjustable expansion device is greater than the outside dimension of the second adjustable expansion device.

[00361] A system for radially expanding and plastically deforming an expandable tubular member within a borehole has been described that includes means for positioning first and second adjustable expansion devices within the expandable tubular member; means for supporting the expandable tubular member and the first and second adjustable expansion devices within the borehole; means for lowering the first adjustable expansion device out of the expandable tubular member; means for increasing the outside dimension of the first adjustable expansion device; means for displacing the first adjustable expansion device upwardly relative to the expandable tubular member to radially expand and plastically deform a lower portion of the expandable tubular member; means for pressurizing an interior

region of the expandable tubular member above the first adjustable expansion device during the radial expansion of the lower portion of the expandable tubular member by the first adjustable expansion device; means for displacing the first adjustable expansion device and the second adjustable expansion device downwardly relative to the expandable tubular member; means for decreasing the outside dimension of the first adjustable expansion device and increasing the outside dimension of the second adjustable expansion device; means for displacing the second adjustable expansion device upwardly relative to the expandable tubular member to radially expand and plastically deform portions of the expandable tubular member above the lower portion of the expandable tubular member; and means for pressurizing an interior region of the expandable tubular member above the second adjustable expansion device during the radial expansion of the portions of the expandable tubular member above the lower portion of the expandable tubular member by the second adjustable expansion device; wherein the outside dimension of the first adjustable expansion device is greater than the outside dimension of the second adjustable expansion device.

[00362] A system for forming a mono diameter wellbore casing has been described that includes means for positioning first and second adjustable expansion devices within a first expandable tubular member; means for supporting the first expandable tubular member and the first and second adjustable expansion devices within a borehole; means for lowering the first adjustable expansion device out of the first expandable tubular member; means for increasing the outside dimension of the first adjustable expansion device; means for displacing the first adjustable expansion device upwardly relative to the first expandable tubular member to radially expand and plastically deform a lower portion of the first expandable tubular member; means for pressurizing an interior region of the first expandable tubular member above the first adjustable expansion device during the radial expansion of the lower portion of the first expandable tubular member by the first adjustable expansion device; means for displacing the first adjustable expansion device and the second adjustable expansion device downwardly relative to the first expandable tubular member; means for decreasing the outside dimension of the first adjustable expansion device and increasing the outside dimension of the second adjustable expansion device; means for displacing the second adjustable expansion device upwardly relative to the first expandable tubular member to radially expand and plastically deform portions of the first expandable tubular member above the lower portion of the expandable tubular member; means for pressurizing an interior region of the first expandable tubular member above the second adjustable expansion device during the radial expansion of the portions of the first expandable tubular member above the lower portion of the first expandable tubular member by the second adjustable expansion device; means for positioning first and second adjustable expansion

devices within a second expandable tubular member; means for supporting the first expandable tubular member and the first and second adjustable expansion devices within the borehole in overlapping relation to the first expandable tubular member; means for lowering the first adjustable expansion device out of the second expandable tubular member; means for increasing the outside dimension of the first adjustable expansion device; means for displacing the first adjustable expansion device upwardly relative to the second expandable tubular member to radially expand and plastically deform a lower portion of the second expandable tubular member; means for pressurizing an interior region of the second expandable tubular member above the first adjustable expansion device during the radial expansion of the lower portion of the second expandable tubular member by the first adjustable expansion device; means for displacing the first adjustable expansion device and the second adjustable expansion device downwardly relative to the second expandable tubular member; means for decreasing the outside dimension of the first adjustable expansion device and increasing the outside dimension of the second adjustable expansion device; means for displacing the second adjustable expansion device upwardly relative to the second expandable tubular member to radially expand and plastically deform portions of the second expandable tubular member above the lower portion of the second expandable tubular member; and means for pressurizing an interior region of the second expandable tubular member above the second adjustable expansion device during the radial expansion of the portions of the second expandable tubular member above the lower portion of the second expandable tubular member by the second adjustable expansion device; wherein the outside dimension of the first adjustable expansion device is greater than the outside dimension of the second adjustable expansion device.

[00363] A system for radially expanding and plastically deforming an expandable tubular member within a borehole has been described that includes means for supporting the expandable tubular member, an hydraulic actuator, and an adjustable expansion device within the borehole; means for increasing the size of the adjustable expansion device; and means for displacing the adjustable expansion device upwardly relative to the expandable tubular member using the hydraulic actuator to radially expand and plastically deform a portion of the expandable tubular member. In an exemplary embodiment, the system further includes means for reducing the size of the adjustable expansion device after the portion of the expandable tubular member has been radially expanded and plastically deformed. In an exemplary embodiment, the system further includes means for fluidicly sealing the radially expanded and plastically deformed end of the expandable tubular member after reducing the size of the adjustable expansion device. In an exemplary embodiment, the system further includes means for permitting the position of the expandable tubular member to float relative to the position of the hydraulic actuator after fluidicly sealing the radially expanded and

plastically deformed end of the expandable tubular member. In an exemplary embodiment, the system further includes means for injecting a hardenable fluidic sealing material into an annulus between the expandable tubular member and a preexisting structure after permitting the position of the expandable tubular member to float relative to the position of the hydraulic actuator. In an exemplary embodiment, the system further includes means for increasing the size of the adjustable expansion device after permitting the position of the expandable tubular member to float relative to the position of the hydraulic actuator. In an exemplary embodiment, system further includes means for displacing the adjustable expansion cone upwardly relative to the expandable tubular member to radially expand and plastically deform another portion of the expandable tubular member. In an exemplary embodiment, the system further includes if the end of the other portion of the expandable tubular member overlaps with a preexisting structure, then means for not permitting the position of the expandable tubular member to float relative to the position of the hydraulic actuator; and means for displacing the adjustable expansion cone upwardly relative to the expandable tubular member using the hydraulic actuator to radially expand and plastically deform the end of the other portion of the expandable tubular member that overlaps with the preexisting structure.

[00364] A system for forming a mono diameter wellbore casing within a borehole that includes a preexisting wellbore casing has been described that includes means for supporting the expandable tubular member, an hydraulic actuator, and an adjustable expansion device within the borehole; means for increasing the size of the adjustable expansion device; means for displacing the adjustable expansion device upwardly relative to the expandable tubular member using the hydraulic actuator to radially expand and plastically deform a portion of the expandable tubular member; and means for displacing the adjustable expansion device upwardly relative to the expandable tubular member to radially expand and plastically deform the remaining portion of the expandable tubular member and a portion of the preexisting wellbore casing that overlaps with an end of the remaining portion of the expandable tubular member. In an exemplary embodiment, the system further includes means for reducing the size of the adjustable expansion device after the portion of the expandable tubular member has been radially expanded and plastically deformed. In an exemplary embodiment, the system further includes means for fluidicly sealing the radially expanded and plastically deformed end of the expandable tubular member after reducing the size of the adjustable expansion device. In an exemplary embodiment, the system further includes means for permitting the position of the expandable tubular member to float relative to the position of the hydraulic actuator after fluidicly sealing the radially expanded and plastically deformed end of the expandable tubular member. In an exemplary embodiment, the system further includes means for injecting a hardenable fluidic sealing material into an

annulus between the expandable tubular member and the borehole after permitting the position of the expandable tubular member to float relative to the position of the hydraulic actuator. In an exemplary embodiment, the system further includes means for increasing the size of the adjustable expansion device after permitting the position of the expandable tubular member to float relative to the position of the hydraulic actuator. In an exemplary embodiment, the system further includes means for displacing the adjustable expansion cone upwardly relative to the expandable tubular member to radially expand and plastically deform the remaining portion of the expandable tubular member. In an exemplary embodiment, the system further includes means for not permitting the position of the expandable tubular member to float relative to the position of the hydraulic actuator; and means for displacing the adjustable expansion cone upwardly relative to the expandable tubular member using the hydraulic actuator to radially expand and plastically deform the end of the remaining portion of the expandable tubular member that overlaps with the preexisting wellbore casing after not permitting the position of the expandable tubular member to float relative to the position of the hydraulic actuator.

[00365] A system for radially expanding and plastically deforming a tubular member has been described that includes means for positioning the tubular member within a preexisting structure; means for radially expanding and plastically deforming a lower portion of the tubular member to form a bell section; and means for radially expanding and plastically deforming a portion of the tubular member above the bell section. In an exemplary embodiment, positioning the tubular member within a preexisting structure includes means for locking the tubular member to an expansion device. In an exemplary embodiment, the outside diameter of the expansion device is less than the inside diameter of the tubular member. In an exemplary embodiment, the expansion device is positioned within the tubular member. In an exemplary embodiment, the expansion device includes an adjustable expansion device. In an exemplary embodiment, the adjustable expansion device is adjustable to a plurality of sizes. In an exemplary embodiment, the expansion device includes a plurality of expansion devices. In an exemplary embodiment, at least one of the expansion devices includes an adjustable expansion device. In an exemplary embodiment, at least one of the adjustable expansion device is adjustable to a plurality of sizes. In an exemplary embodiment, means for radially expanding and plastically deforming a lower portion of the tubular member to form a bell section includes means for lowering an expansion device out of an end of the tubular member; and means for pulling the expansion device through the end of the tubular member. In an exemplary embodiment, means for lowering an expansion device out of an end of the tubular member includes means for lowering the expansion device out of the end of the tubular member; and means for adjusting the size of the expansion device. In an exemplary embodiment, the adjustable

expansion device is adjustable to a plurality of sizes. In an exemplary embodiment, the expansion device includes a plurality of adjustable expansion devices. In an exemplary embodiment, at least one of the adjustable expansion devices is adjustable to a plurality of sizes. In an exemplary embodiment, means for pulling the expansion device through the end of the tubular member includes means for gripping the tubular member; and means for pulling an expansion device through an end of the tubular member. In an exemplary embodiment, means for gripping the tubular member includes means for permitting axial displacement of the tubular member in a first direction; and means for not permitting axial displacement of the tubular member in a second direction. In an exemplary embodiment, means for pulling the expansion device through the end of the tubular member includes means for pulling the expansion device through the end of the tubular member using an actuator. In an exemplary embodiment, means for radially expanding and plastically deforming a portion of the tubular member above the bell section includes means for lowering an expansion device out of an end of the tubular member; and means for pulling the expansion device through the end of the tubular member. In an exemplary embodiment, means for lowering an expansion device out of an end of the tubular member includes means for lowering the expansion device out of the end of the tubular member; and means for adjusting the size of the expansion device. In an exemplary embodiment, the adjustable expansion device is adjustable to a plurality of sizes. In an exemplary embodiment, the expansion device comprises a plurality of adjustable expansion devices. In an exemplary embodiment, at least one of the adjustable expansion devices is adjustable to a plurality of sizes. In an exemplary embodiment, means for pulling the expansion device through the end of the tubular member includes means for gripping the tubular member; and means for pulling an expansion device through an end of the tubular member. In an exemplary embodiment, means for gripping the tubular member includes means for permitting axial displacement of the tubular member in a first direction; and means for not permitting axial displacement of the tubular member in a second direction. In an exemplary embodiment, means for pulling the expansion device through the end of the tubular member includes means for pulling the expansion device through the end of the tubular member using an actuator. In an exemplary embodiment, means for pulling the expansion device through the end of the tubular member includes means for pulling the expansion device through the end of the tubular member using fluid pressure. In an exemplary embodiment, means for pulling the expansion device through the end of the tubular member using fluid pressure includes means for pressurizing an annulus within the tubular member above the expansion device. In an exemplary embodiment, means for radially expanding and plastically deforming a portion of the tubular member above the bell section includes means for fluidicly sealing an end of the tubular member; and means for pulling the expansion device through the tubular

member. In an exemplary embodiment, the expansion device is adjustable. In an exemplary embodiment, the expansion device is adjustable to a plurality of sizes. In an exemplary embodiment, the expansion device includes a plurality of adjustable expansion devices. In an exemplary embodiment, at least one of the adjustable expansion devices is adjustable to a plurality of sizes. In an exemplary embodiment, means for pulling the expansion device through the end of the tubular member includes means for gripping the tubular member; and means for pulling an expansion device through an end of the tubular member. In an exemplary embodiment, means for gripping the tubular member includes means for permitting axial displacement of the tubular member in a first direction; and means for not permitting axial displacement of the tubular member in a second direction. In an exemplary embodiment, means for pulling the expansion device through the end of the tubular member includes means for pulling the expansion device through the end of the tubular member using an actuator. In an exemplary embodiment, means for pulling the expansion device through the end of the tubular member includes means for pulling the expansion device through the end of the tubular member using fluid pressure. In an exemplary embodiment, means for pulling the expansion device through the end of the tubular member using fluid pressure includes means for pressurizing an annulus within the tubular member above the expansion device. In an exemplary embodiment, means for radially expanding and plastically deforming a portion of the tubular member above the bell section includes means for overlapping the portion of the tubular member above the bell section with an end of a preexisting tubular member; and means for pulling an expansion device through the overlapping portions of the tubular member and the preexisting tubular member. In an exemplary embodiment, the expansion device is adjustable. In an exemplary embodiment, the expansion device is adjustable to a plurality of sizes. In an exemplary embodiment, the expansion device includes a plurality of adjustable expansion devices. In an exemplary embodiment, at least one of the adjustable expansion devices is adjustable to a plurality of sizes. In an exemplary embodiment, means for pulling the expansion device through the overlapping portions of the tubular member and the preexisting tubular member includes means for gripping the tubular member; and means for pulling the expansion device through the overlapping portions of the tubular member and the preexisting tubular member. In an exemplary embodiment, means for gripping the tubular member includes means for permitting axial displacement of the tubular member in a first direction; and means for not permitting axial displacement of the tubular member in a second direction. In an exemplary embodiment, means for pulling the expansion device through the overlapping portions of the tubular member and the preexisting tubular member includes means for pulling the expansion device through the overlapping portions of the tubular member and the preexisting tubular member using an actuator. In an exemplary

embodiment, means for pulling the expansion device through the overlapping portions of the tubular member and the preexisting tubular member includes means for pulling the expansion device through the overlapping portions of the tubular member and the preexisting tubular member using fluid pressure. In an exemplary embodiment, means for pulling the expansion device through the overlapping portions of the tubular member and the preexisting tubular member using fluid pressure includes means for pressurizing an annulus within the tubular member above the expansion device. In an exemplary embodiment, the system further includes means for cutting an end of the portion of the tubular member that overlaps with the preexisting tubular member. In an exemplary embodiment, the system further includes means for removing the cut off end of the expandable tubular member from the preexisting structure. In an exemplary embodiment, the system further includes means for injecting a hardenable fluidic sealing material into an annulus between the expandable tubular member and the preexisting structure. In an exemplary embodiment, the system further includes means for cutting off an end of the expandable tubular member. In an exemplary embodiment, the system further includes means for removing the cut off end of the expandable tubular member from the preexisting structure.

[00366] A system of radially expanding and plastically deforming a tubular member has been described that includes a support member; and means for applying internal pressure to the inside surface of the tubular member at a plurality of discrete location separated from one another coupled to the support member.

[00367] A method of cutting a tubular member has been described that includes positioning a plurality of cutting elements within the tubular member; and bringing the cutting elements into engagement with the tubular member. In an exemplary embodiment, the cutting elements include a first group of cutting elements; and a second group of cutting elements; wherein the first group of cutting elements are interleaved with the second group of cutting elements. In an exemplary embodiment, bringing the cutting elements into engagement with the tubular member includes bringing the cutting elements into axial alignment. In an exemplary embodiment, bringing the cutting elements into engagement with the tubular member further includes pivoting the cutting elements. In an exemplary embodiment, bringing the cutting elements into engagement with the tubular member further includes translating the cutting elements. In an exemplary embodiment, bringing the cutting elements into engagement with the tubular member further includes pivoting the cutting elements; and translating the cutting elements. In an exemplary embodiment, bringing the cutting elements into engagement with the tubular member includes rotating the cutting elements about a common axis. In an exemplary embodiment, bringing the cutting elements into engagement with the tubular member includes pivoting the cutting elements about corresponding axes; translating the cutting elements; and rotating the cutting elements

about a common axis. In an exemplary embodiment, the method further includes preventing the cutting elements from coming into engagement with the tubular member if the inside diameter of the tubular member is less than a predetermined value. In an exemplary embodiment, preventing the cutting elements from coming into engagement with the tubular member if the inside diameter of the tubular member is less than a predetermined value includes sensing the inside diameter of the tubular member.

[00368] A method of gripping a tubular member has been described that includes positioning a plurality of gripping elements within the tubular member; bringing the gripping elements into engagement with the tubular member. In an exemplary embodiment, bringing the gripping elements into engagement with the tubular member includes displacing the gripping elements in an axial direction; and displacing the gripping elements in a radial direction. In an exemplary embodiment, the method further includes biasing the gripping elements against engagement with the tubular member.

[00369] A method of operating an actuator has been described that includes pressurizing a plurality of pressure chamber. In an exemplary embodiment, the method further includes transmitting torsional loads.

[00370] A method of injecting a hardenable fluidic sealing material into an annulus between a tubular member and a preexisting structure has been described that includes positioning the tubular member into the preexisting structure; sealing off an end of the tubular member; operating a valve within the end of the tubular member; and injecting a hardenable fluidic sealing material through the valve into the annulus between the tubular member and the preexisting structure.

[00371] A system for cutting a tubular member has been described that includes means for positioning a plurality of cutting elements within the tubular member; and means for bringing the cutting elements into engagement with the tubular member. In an exemplary embodiment, the cutting elements include a first group of cutting elements; and a second group of cutting elements; wherein the first group of cutting elements are interleaved with the second group of cutting elements. In an exemplary embodiment, means for bringing the cutting elements into engagement with the tubular member includes means for bringing the cutting elements into axial alignment. In an exemplary embodiment, means for bringing the cutting elements into engagement with the tubular member further includes means for pivoting the cutting elements. In an exemplary embodiment, means for bringing the cutting elements into engagement with the tubular member further includes means for translating the cutting elements. In an exemplary embodiment, means for bringing the cutting elements into engagement with the tubular member further includes means for pivoting the cutting elements; and means for translating the cutting elements. In an exemplary embodiment, means for bringing the cutting elements into engagement with the tubular member includes

means for rotating the cutting elements about a common axis. In an exemplary embodiment, means for bringing the cutting elements into engagement with the tubular member includes means for pivoting the cutting elements about corresponding axes; means for translating the cutting elements; and means for rotating the cutting elements about a common axis. In an exemplary embodiment, the system further includes means for preventing the cutting elements from coming into engagement with the tubular member if the inside diameter of the tubular member is less than a predetermined value. In an exemplary embodiment, means for preventing the cutting elements from coming into engagement with the tubular member if the inside diameter of the tubular member is less than a predetermined value includes means for sensing the inside diameter of the tubular member.

[00372] A system for gripping a tubular member has been described that includes means for positioning a plurality of gripping elements within the tubular member; and means for bringing the gripping elements into engagement with the tubular member. In an exemplary embodiment, means for bringing the gripping elements into engagement with the tubular member includes means for displacing the gripping elements in an axial direction; and means for displacing the gripping elements in a radial direction. In an exemplary embodiment, the system further includes means for biasing the gripping elements against engagement with the tubular member.

[00373] An actuator system has been described that includes a support member; and means for pressurizing a plurality of pressure chambers coupled to the support member. In an exemplary embodiment, the system further includes means for transmitting torsional loads.

[00374] A system for injecting a hardenable fluidic sealing material into an annulus between a tubular member and a preexisting structure has been described that includes means for positioning the tubular member into the preexisting structure; means for sealing off an end of the tubular member; means for operating a valve within the end of the tubular member; and means for injecting a hardenable fluidic sealing material through the valve into the annulus between the tubular member and the preexisting structure.

[00375] A method of engaging a tubular member has been described that includes positioning a plurality of elements within the tubular member; and bringing the elements into engagement with the tubular member. In an exemplary embodiment, the elements include a first group of elements; and a second group of elements; wherein the first group of elements are interleaved with the second group of elements. In an exemplary embodiment, bringing the elements into engagement with the tubular member includes bringing the elements into axial alignment. In an exemplary embodiment, bringing the elements into engagement with the tubular member further includes pivoting the elements. In an exemplary embodiment, bringing the elements into engagement with the tubular member further includes translating

the elements. In an exemplary embodiment, bringing the elements into engagement with the tubular member further includes pivoting the elements; and translating the elements. In an exemplary embodiment, bringing the elements into engagement with the tubular member includes rotating the elements about a common axis. In an exemplary embodiment, bringing the elements into engagement with the tubular member includes pivoting the elements about corresponding axes; translating the elements; and rotating the elements about a common axis. In an exemplary embodiment, the method further includes preventing the elements from coming into engagement with the tubular member if the inside diameter of the tubular member is less than a predetermined value. In an exemplary embodiment, preventing the elements from coming into engagement with the tubular member if the inside diameter of the tubular member is less than a predetermined value includes sensing the inside diameter of the tubular member.

[00376] A system for engaging a tubular member has been described that includes means for positioning a plurality of elements within the tubular member; and means for bringing the elements into engagement with the tubular member. In an exemplary embodiment, the elements include a first group of elements; and a second group of elements; wherein the first group of elements are interleaved with the second group of elements. In an exemplary embodiment, means for bringing the elements into engagement with the tubular member includes means for bringing the elements into axial alignment. In an exemplary embodiment, means for bringing the elements into engagement with the tubular member further includes means for pivoting the elements. In an exemplary embodiment, means for bringing the elements into engagement with the tubular member further includes means for translating the elements. In an exemplary embodiment, means for bringing the elements into engagement with the tubular member further includes means for pivoting the elements; and means for translating the elements. In an exemplary embodiment, means for bringing the elements into engagement with the tubular member includes means for rotating the elements about a common axis. In an exemplary embodiment, means for bringing the elements into engagement with the tubular member includes means for pivoting the elements about corresponding axes; means for translating the elements; and means for rotating the elements about a common axis. In an exemplary embodiment, the system further includes means for preventing the elements from coming into engagement with the tubular member if the inside diameter of the tubular member is less than a predetermined value. In an exemplary embodiment, means for preventing the elements from coming into engagement with the tubular member if the inside diameter of the tubular member is less than a predetermined value includes means for sensing the inside diameter of the tubular member.

[00377] It is understood that variations may be made in the foregoing without departing from the scope of the invention. For example, the teachings of the present illustrative embodiments may be used to provide a wellbore casing, a pipeline, or a structural support. Furthermore, the elements and teachings of the various illustrative embodiments may be combined in whole or in part in some or all of the illustrative embodiments.

[00378] Although illustrative embodiments of the invention have been shown and described, a wide range of modification, changes and substitution is contemplated in the foregoing disclosure. In some instances, some features of the present invention may be employed without a corresponding use of the other features. Accordingly, it is appropriate that the appended claims be construed broadly and in a manner consistent with the scope of the invention.

Claims

What is claimed is:

1. An apparatus for radially expanding and plastically deforming an expandable tubular member, comprising:

a support member;

a cutting device for cutting the tubular member coupled to the support member; and

an expansion device for radially expanding and plastically deforming the tubular member coupled to the support member.

2. The apparatus of claim 1, further comprising:

a gripping device for gripping the tubular member coupled to the support member.

3. The apparatus of claim 2, wherein the gripping device comprises a plurality of movable gripping elements.

4. The apparatus of claim 3, wherein the gripping elements are moveable in a radial direction relative to the support member.

5. The apparatus of claim 3, wherein the gripping elements are moveable in an axial direction relative to the support member.

6. The apparatus of claim 3, wherein the gripping elements are moveable in a radial and an axial direction relative to the support member.

7. The apparatus of claim 3, wherein the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in a radial and an axial direction relative to the support member.

8. The apparatus of claim 3, wherein the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in a radial direction relative to the support member.

9. The apparatus of claim 3, wherein the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in an axial direction relative to the support member.

10. The apparatus of claim 3, wherein, if the tubular member is displaced in a first axial direction, the gripping device grips the tubular member; and wherein, if the tubular member is displaced in a second axial direction, the gripping device does not grip the tubular member.

11. The apparatus of claim 3, wherein the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, the gripping elements are biased to remain in the first position.

12. The apparatus of claim 3, wherein the gripping device further comprises:

an actuator for moving the gripping elements from a first position to a second position;

wherein in the first position, the gripping elements do not engage the tubular member;

wherein in the second position, the gripping elements do engage the tubular member; and

wherein the actuator is a fluid powered actuator.

13. The apparatus of claim 1, further comprising:

a sealing device for sealing an interface with the tubular member coupled to the support member.

14. The apparatus of claim 13, wherein the sealing device seals an annulus defines between the support member and the tubular member.

15. The apparatus of claim 1, further comprising:

a locking device for locking the position of the tubular member relative to the support member.

16. The apparatus of claim 1, further comprising:
a packer assembly coupled to the support member.

17. The apparatus of claim 16, wherein the packer assembly comprises:
a packer; and
a packer control device for controlling the operation of the packer coupled to the support member.

18. The apparatus of claim 17, wherein the packer comprises:
a support member defining a passage;
a shoe comprising a float valve coupled to an end of the support member;
one or more compressible packer elements movably coupled to the support member; and
a sliding sleeve valve movably positioned within the passage of the support member.

19. The apparatus of claim 17, wherein the packer control device comprises:
a support member;
one or more drag blocks releasably coupled to the support member; and
a stinger coupled to the support member for engaging the packer.

20. The apparatus of claim 17, wherein the packer comprises:
a support member defining a passage;
a shoe comprising a float valve coupled to an end of the support member;
one or more compressible packer elements movably coupled to the support member; and
a sliding sleeve valve positioned within the passage of the support member; and
wherein the packer control device comprises:
a support member;
one or more drag blocks releasably coupled to the support member; and
a stinger coupled to the support member for engaging the sliding sleeve valve.

21. The apparatus of claim 1, further comprising:

an actuator for displacing the expansion device relative to the support member.

22. The apparatus of claim 21, wherein the actuator comprises:
a first actuator for pulling the expansion device; and
a second actuator for pushing the expansion device.

23. The apparatus of claim 21, wherein the actuator comprises means for transferring torsional loads between the support member and the expansion device.

24. The apparatus of claim 22, wherein the first and second actuators comprise means for transferring torsional loads between the support member and the expansion device.

25. The apparatus of claim 21, wherein the actuator comprises a plurality of pistons positioned within corresponding piston chambers.

26. The apparatus of claim 1, wherein the cutting device comprises:
a support member; and
a plurality of movable cutting elements coupled to the support member.

27. The apparatus of claim 26, further comprising:
an actuator coupled to the support member for moving the cutting elements between a first position and a second position;
wherein in the first position, the cutting elements do not engage the tubular member; and
wherein in the second position, the cutting elements engage the tubular member.

28. The apparatus of claim 27, further comprising:
a sensor coupled to the support member for sensing the internal diameter of the tubular member.

29. The apparatus of claim 28, wherein the sensor prevents the cutting elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value.

30. The apparatus of claim 27, wherein the cutting elements comprise:
a first set of cutting elements; and
a second set of cutting elements;

wherein the first set of cutting elements are interleaved with the second set of cutting elements.

31. The apparatus of claim 30, wherein in the first position, the first set of cutting elements are not axially aligned with the second set of cutting elements.

32. The apparatus of claim 30, wherein in the second position, the first set of cutting elements are axially aligned with the second set of cutting elements.

33. The apparatus of claim 1, wherein the expansion device comprises:
a support member; and
a plurality of movable expansion elements coupled to the support member.

34. The apparatus of claim 33, further comprising:
an actuator coupled to the support member for moving the expansion elements between a first position and a second position;
wherein in the first position, the expansion elements do not engage the tubular member; and
wherein in the second position, the expansion elements engage the tubular member.

35. The apparatus of claim 34, further comprising:
a sensor coupled to the support member for sensing the internal diameter of the tubular member.

36. The apparatus of claim 35, wherein the sensor prevents the expansion elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value.

37. The apparatus of claim 34, wherein the expansion elements comprise:
a first set of expansion elements; and
a second set of expansion elements;
wherein the first set of expansion elements are interleaved with the second set of expansion elements.

38. The apparatus of claim 37, wherein in the first position, the first set of expansion elements are not axially aligned with the second set of expansion elements.

39. The apparatus of claim 37, wherein in the second position, the first set of expansion elements are axially aligned with the second set of expansion elements.

40. The apparatus of claim 1, wherein the expansion device comprises an adjustable expansion device.

41. The apparatus of claim 1, wherein the expansion device comprises a plurality of expansion devices.

42. The apparatus of claim 41, wherein at least one of the expansion devices comprises an adjustable expansion device.

43. The apparatus of claim 42, wherein the adjustable expansion device comprises:
a support member; and
a plurality of movable expansion elements coupled to the support member.

44. The apparatus of claim 43, further comprising:
an actuator coupled to the support member for moving the expansion elements between a first position and a second position;
wherein in the first position, the expansion elements do not engage the tubular member; and
wherein in the second position, the expansion elements engage the tubular member.

45. The apparatus of claim 44, further comprising:
a sensor coupled to the support member for sensing the internal diameter of the tubular member.

46. The apparatus of claim 45, wherein the sensor prevents the expansion elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value.

47. The apparatus of claim 44, wherein the expansion elements comprise:
a first set of expansion elements; and
a second set of expansion elements;
wherein the first set of expansion elements are interleaved with the second set of expansion elements.

48. The apparatus of claim 47, wherein in the first position, the first set of expansion elements are not axially aligned with the second set of expansion elements.

49. The apparatus of claim 47, wherein in the second position, the first set of expansion elements are axially aligned with the second set of expansion elements.

50. An apparatus for radially expanding and plastically deforming an expandable tubular member, comprising:

a support member;

an expansion device for radially expanding and plastically deforming the tubular member coupled to the support member; and

an actuator coupled to the support member for displacing the expansion device relative to the support member.

51. The apparatus of claim 50, further comprising:

a cutting device coupled to the support member for cutting the tubular member.

52. The apparatus of claim 51, wherein the cutting device comprises:

a support member; and

a plurality of movable cutting elements coupled to the support member.

53. The apparatus of claim 52, further comprising:

an actuator coupled to the support member for moving the cutting elements between a first position and a second position;

wherein in the first position, the cutting elements do not engage the tubular member; and

wherein in the second position, the cutting elements engage the tubular member.

54. The apparatus of claim 53, further comprising:

a sensor coupled to the support member for sensing the internal diameter of the tubular member.

55. The apparatus of claim 54, wherein the sensor prevents the cutting elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value.

56. The apparatus of claim 53, wherein the cutting elements comprise:

a first set of cutting elements; and

a second set of cutting elements;

wherein the first set of cutting elements are interleaved with the second set of cutting elements.

57. The apparatus of claim 56, wherein in the first position, the first set of cutting elements are not axially aligned with the second set of cutting elements.

58. The apparatus of claim 56, wherein in the second position, the first set of cutting elements are axially aligned with the second set of cutting elements.

59. The apparatus of claim 50, further comprising:
a gripping device for gripping the tubular member coupled to the support member.

60. The apparatus of claim 59, wherein the gripping device comprises a plurality of movable gripping elements.

61. The apparatus of claim 60, wherein the gripping elements are moveable in a radial direction relative to the support member.

62. The apparatus of claim 60, wherein the gripping elements are moveable in an axial direction relative to the support member.

63. The apparatus of claim 60, wherein the gripping elements are moveable in a radial and an axial direction relative to the support member.

64. The apparatus of claim 60, wherein the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in a radial and an axial direction relative to the support member.

65. The apparatus of claim 60, wherein the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, during the movement from the first position to the

second position, the gripping elements move in a radial direction relative to the support member.

66. The apparatus of claim 60, wherein the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in an axial direction relative to the support member.

67. The apparatus of claim 50, wherein, if the tubular member is displaced in a first axial direction, the gripping device grips the tubular member; and wherein, if the tubular member is displaced in a second axial direction, the gripping device does not grip the tubular member.

68. The apparatus of claim 60, wherein the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, the gripping elements are biased to remain in the first position.

69. The apparatus of claim 60, wherein the gripping device further comprises:

an actuator for moving the gripping elements from a first position to a second position;

wherein in the first position, the gripping elements do not engage the tubular member;

wherein in the second position, the gripping elements do engage the tubular member; and

wherein the actuator is a fluid powered actuator.

70. The apparatus of claim 50, further comprising:

a sealing device for sealing an interface with the tubular member coupled to the support member.

71. The apparatus of claim 70, wherein the sealing device seals an annulus defines between the support member and the tubular member.

72. The apparatus of claim 50, further comprising:

a locking device for locking the position of the tubular member relative to the support member.

73. The apparatus of claim 50, further comprising:

a packer assembly coupled to the support member.

74. The apparatus of claim 73, wherein the packer assembly comprises:

a packer; and

a packer control device for controlling the operation of the packer coupled to the support member.

75. The apparatus of claim 74, wherein the packer comprises:

a support member defining a passage;

a shoe comprising a float valve coupled to an end of the support member;

one or more compressible packer elements movably coupled to the support member; and

a sliding sleeve valve movably positioned within the passage of the support member.

76. The apparatus of claim 74, wherein the packer control device comprises:

a support member;

one or more drag blocks releasably coupled to the support member; and

a stinger coupled to the support member for engaging the packer.

77. The apparatus of claim 74, wherein the packer comprises:

a support member defining a passage;

a shoe comprising a float valve coupled to an end of the support member;

one or more compressible packer elements movably coupled to the support member; and

a sliding sleeve valve positioned within the passage of the support member; and

wherein the packer control device comprises:

a support member;

one or more drag blocks releasably coupled to the support member; and

a stinger coupled to the support member for engaging the sliding sleeve valve.

78. The apparatus of claim 50, wherein the expansion device comprises:
a support member; and
a plurality of movable expansion elements coupled to the support member.

79. The apparatus of claim 78, further comprising:
an actuator coupled to the support member for moving the expansion elements between a first position and a second position;
wherein in the first position, the expansion elements do not engage the tubular member; and
wherein in the second position, the expansion elements engage the tubular member.

80. The apparatus of claim 79, further comprising:
a sensor coupled to the support member for sensing the internal diameter of the tubular member.

81. The apparatus of claim 80, wherein the sensor prevents the expansion elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value.

82. The apparatus of claim 79, wherein the expansion elements comprise:
a first set of expansion elements; and
a second set of expansion elements;
wherein the first set of expansion elements are interleaved with the second set of expansion elements.

83. The apparatus of claim 82, wherein in the first position, the first set of expansion elements are not axially aligned with the second set of expansion elements.

84. The apparatus of claim 82, wherein in the second position, the first set of expansion elements are axially aligned with the second set of expansion elements.

85. The apparatus of claim 50, wherein the expansion device comprises an adjustable expansion device.

86. The apparatus of claim 50, wherein the expansion device comprises a plurality of expansion devices.

87. The apparatus of claim 86, wherein at least one of the expansion devices comprises an adjustable expansion device.

88. The apparatus of claim 87, wherein the adjustable expansion device comprises:
a support member; and
a plurality of movable expansion elements coupled to the support member.

89. The apparatus of claim 88, further comprising:
an actuator coupled to the support member for moving the expansion elements between a first position and a second position;
wherein in the first position, the expansion elements do not engage the tubular member; and
wherein in the second position, the expansion elements engage the tubular member.

90. The apparatus of claim 89, further comprising:
a sensor coupled to the support member for sensing the internal diameter of the tubular member.

91. The apparatus of claim 90, wherein the sensor prevents the expansion elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value.

92. The apparatus of claim 89, wherein the expansion elements comprise:
a first set of expansion elements; and
a second set of expansion elements;
wherein the first set of expansion elements are interleaved with the second set of expansion elements.

93. The apparatus of claim 92, wherein in the first position, the first set of expansion elements are not axially aligned with the second set of expansion elements.

94. The apparatus of claim 92, wherein in the second position, the first set of expansion elements are axially aligned with the second set of expansion elements.

95. An apparatus for radially expanding and plastically deforming an expandable tubular member, comprising:
a support member;

an expansion device for radially expanding and plastically deforming the tubular member coupled to the support member; and

a sealing assembly for sealing an annulus defined between the support member and the tubular member.

96. The apparatus of claim 95, further comprising:
a gripping device for gripping the tubular member coupled to the support member.

97. The apparatus of claim 96, wherein the gripping device comprises a plurality of movable gripping elements.

98. The apparatus of claim 97, wherein the gripping elements are moveable in a radial direction relative to the support member.

99. The apparatus of claim 97, wherein the gripping elements are moveable in an axial direction relative to the support member.

100. The apparatus of claim 97, wherein the gripping elements are moveable in a radial and an axial direction relative to the support member.

101. The apparatus of claim 97, wherein the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in a radial and an axial direction relative to the support member.

102. The apparatus of claim 97, wherein the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in a radial direction relative to the support member.

103. The apparatus of claim 97, wherein the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do

engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in an axial direction relative to the support member.

104. The apparatus of claim 97, wherein, if the tubular member is displaced in a first axial direction, the gripping device grips the tubular member; and wherein, if the tubular member is displaced in a second axial direction, the gripping device does not grip the tubular member.

105. The apparatus of claim 97, wherein the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, the gripping elements are biased to remain in the first position.

106. The apparatus of claim 97, wherein the gripping device further comprises:
an actuator for moving the gripping elements from a first position to a second position;
wherein in the first position, the gripping elements do not engage the tubular member;
wherein in the second position, the gripping elements do engage the tubular member; and
wherein the actuator is a fluid powered actuator.

107. The apparatus of claim 95, further comprising:
a locking device for locking the position of the tubular member relative to the support member.

108. The apparatus of claim 95, further comprising:
a packer assembly coupled to the support member.

109. The apparatus of claim 108, wherein the packer assembly comprises:
a packer; and
a packer control device for controlling the operation of the packer coupled to the support member.

110. The apparatus of claim 109, wherein the packer comprises:

a support member defining a passage;

a shoe comprising a float valve coupled to an end of the support member;

one or more compressible packer elements movably coupled to the support member; and

a sliding sleeve valve movably positioned within the passage of the support member.

111. The apparatus of claim 109, wherein the packer control device comprises:

a support member;

one or more drag blocks releasably coupled to the support member; and

a stinger coupled to the support member for engaging the packer.

112. The apparatus of claim 109, wherein the packer comprises:

a support member defining a passage;

a shoe comprising a float valve coupled to an end of the support member;

one or more compressible packer elements movably coupled to the support member; and

a sliding sleeve valve positioned within the passage of the support member; and

wherein the packer control device comprises:

a support member;

one or more drag blocks releasably coupled to the support member; and

a stinger coupled to the support member for engaging the sliding sleeve valve.

113. The apparatus of claim 95, further comprising:

an actuator for displacing the expansion device relative to the support member.

114. The apparatus of claim 113, wherein the actuator comprises:

a first actuator for pulling the expansion device; and

a second actuator for pushing the expansion device.

115. The apparatus of claim 113, wherein the actuator comprises means for transferring torsional loads between the support member and the expansion device.

116. The apparatus of claim 114, wherein the first and second actuators comprise means for transferring torsional loads between the support member and the expansion device.

117. The apparatus of claim 113, wherein the actuator comprises a plurality of pistons positioned within corresponding piston chambers.

118. The apparatus of claim 95, wherein the cutting device comprises:
a support member; and
a plurality of movable cutting elements coupled to the support member.

119. The apparatus of claim 118, further comprising:
an actuator coupled to the support member for moving the cutting elements between a first position and a second position;
wherein in the first position, the cutting elements do not engage the tubular member; and
wherein in the second position, the cutting elements engage the tubular member.

120. The apparatus of claim 119, further comprising:
a sensor coupled to the support member for sensing the internal diameter of the tubular member.

121. The apparatus of claim 120, wherein the sensor prevents the cutting elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value.

122. The apparatus of claim 119, wherein the cutting elements comprise:
a first set of cutting elements; and
a second set of cutting elements;
wherein the first set of cutting elements are interleaved with the second set of cutting elements.

123. The apparatus of claim 122, wherein in the first position, the first set of cutting elements are not axially aligned with the second set of cutting elements.

124. The apparatus of claim 122, wherein in the second position, the first set of cutting elements are axially aligned with the second set of cutting elements.

125. The apparatus of claim 95, wherein the expansion device comprises:
a support member; and
a plurality of movable expansion elements coupled to the support member.

126. The apparatus of claim 125, further comprising:
an actuator coupled to the support member for moving the expansion elements between a first position and a second position;
wherein in the first position, the expansion elements do not engage the tubular member; and
wherein in the second position, the expansion elements engage the tubular member.

127. The apparatus of claim 126, further comprising:
a sensor coupled to the support member for sensing the internal diameter of the tubular member.

128. The apparatus of claim 127, wherein the sensor prevents the expansion elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value.

129. The apparatus of claim 126, wherein the expansion elements comprise:
a first set of expansion elements; and
a second set of expansion elements;
wherein the first set of expansion elements are interleaved with the second set of expansion elements.

130. The apparatus of claim 129, wherein in the first position, the first set of expansion elements are not axially aligned with the second set of expansion elements.

131. The apparatus of claim 129, wherein in the second position, the first set of expansion elements are axially aligned with the second set of expansion elements.

132. The apparatus of claim 95, wherein the expansion device comprises an adjustable expansion device.

133. The apparatus of claim 95, wherein the expansion device comprises a plurality of expansion devices.

134. The apparatus of claim 133, wherein at least one of the expansion devices comprises an adjustable expansion device.

135. The apparatus of claim 134, wherein the adjustable expansion device comprises:
a support member; and
a plurality of movable expansion elements coupled to the support member.

136. The apparatus of claim 135, further comprising:
an actuator coupled to the support member for moving the expansion elements between a first position and a second position;
wherein in the first position, the expansion elements do not engage the tubular member; and
wherein in the second position, the expansion elements engage the tubular member.

137. The apparatus of claim 136, further comprising:
a sensor coupled to the support member for sensing the internal diameter of the tubular member.

138. The apparatus of claim 137, wherein the sensor prevents the expansion elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value.

139. The apparatus of claim 136, wherein the expansion elements comprise:
a first set of expansion elements; and
a second set of expansion elements;
wherein the first set of expansion elements are interleaved with the second set of expansion elements.

140. The apparatus of claim 139, wherein in the first position, the first set of expansion elements are not axially aligned with the second set of expansion elements.

141. The apparatus of claim 139, wherein in the second position, the first set of expansion elements are axially aligned with the second set of expansion elements.

142. An apparatus for radially expanding and plastically deforming an expandable tubular member, comprising:
a support member;
a first expansion device for radially expanding and plastically deforming the tubular member coupled to the support member; and
a second expansion device for radially expanding and plastically deforming the

tubular member coupled to the support member.

143. The apparatus of claim 142, further comprising:
a gripping device for gripping the tubular member coupled to the support member.

144. The apparatus of claim 143, wherein the gripping device comprises a plurality of movable gripping elements.

145. The apparatus of claim 144, wherein the gripping elements are moveable in a radial direction relative to the support member.

146. The apparatus of claim 144, wherein the gripping elements are moveable in an axial direction relative to the support member.

147. The apparatus of claim 144, wherein the gripping elements are moveable in a radial and an axial direction relative to the support member.

148. The apparatus of claim 144, wherein the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in a radial and an axial direction relative to the support member.

149. The apparatus of claim 144, wherein the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in a radial direction relative to the support member.

150. The apparatus of claim 144, wherein the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in an axial direction relative to the support member.

151. The apparatus of claim 144, wherein, if the tubular member is displaced in a first axial direction, the gripping device grips the tubular member; and wherein, if the tubular member is displaced in a second axial direction, the gripping device does not grip the tubular member.

152. The apparatus of claim 144, wherein the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, the gripping elements are biased to remain in the first position.

153. The apparatus of claim 144, wherein the gripping device further comprises:

an actuator for moving the gripping elements from a first position to a second position;

wherein in the first position, the gripping elements do not engage the tubular member;

wherein in the second position, the gripping elements do engage the tubular member; and

wherein the actuator is a fluid powered actuator.

154. The apparatus of claim 142, further comprising:

a sealing device for sealing an interface with the tubular member coupled to the support member.

155. The apparatus of claim 154, wherein the sealing device seals an annulus defines between the support member and the tubular member.

156. The apparatus of claim 142, further comprising:

a locking device for locking the position of the tubular member relative to the support member.

157. The apparatus of claim 142, further comprising:

a packer assembly coupled to the support member.

158. The apparatus of claim 157, wherein the packer assembly comprises:

a packer; and

a packer control device for controlling the operation of the packer coupled to the support member.

159. The apparatus of claim 158, wherein the packer comprises:
a support member defining a passage;
a shoe comprising a float valve coupled to an end of the support member;
one or more compressible packer elements movably coupled to the support member; and
a sliding sleeve valve movably positioned within the passage of the support member.

160. The apparatus of claim 158, wherein the packer control device comprises:
a support member;
one or more drag blocks releasably coupled to the support member; and
a stinger coupled to the support member for engaging the packer.

161. The apparatus of claim 158, wherein the packer comprises:
a support member defining a passage;
a shoe comprising a float valve coupled to an end of the support member;
one or more compressible packer elements movably coupled to the support member; and
a sliding sleeve valve positioned within the passage of the support member; and
wherein the packer control device comprises:
a support member;
one or more drag blocks releasably coupled to the support member; and
a stinger coupled to the support member for engaging the sliding sleeve valve.

162. The apparatus of claim 142, further comprising:
an actuator for displacing the expansion device relative to the support member.

163. The apparatus of claim 162, wherein the actuator comprises:
a first actuator for pulling the expansion device; and
a second actuator for pushing the expansion device.

164. The apparatus of claim 162, wherein the actuator comprises means for transferring torsional loads between the support member and the expansion device.

165. The apparatus of claim 163, wherein the first and second actuators comprise means for transferring torsional loads between the support member and the expansion device.

166. The apparatus of claim 162, wherein the actuator comprises a plurality of pistons positioned within corresponding piston chambers.

167. The apparatus of claim 142, further comprising:
a cutting device for cutting the tubular member coupled to the support member.

168. The apparatus of claim 167, wherein the cutting device comprises:
a support member; and
a plurality of movable cutting elements coupled to the support member.

169. The apparatus of claim 168, further comprising:
an actuator coupled to the support member for moving the cutting elements between a first position and a second position;
wherein in the first position, the cutting elements do not engage the tubular member; and
wherein in the second position, the cutting elements engage the tubular member.

170. The apparatus of claim 169, further comprising:
a sensor coupled to the support member for sensing the internal diameter of the tubular member.

171. The apparatus of claim 170, wherein the sensor prevents the cutting elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value.

172. The apparatus of claim 169, wherein the cutting elements comprise:
a first set of cutting elements; and
a second set of cutting elements;
wherein the first set of cutting elements are interleaved with the second set of cutting elements.

173. The apparatus of claim 172, wherein in the first position, the first set of cutting elements are not axially aligned with the second set of cutting elements.

174. The apparatus of claim 172, wherein in the second position, the first set of cutting elements are axially aligned with the second set of cutting elements.

175. The apparatus of claim 142, wherein at least one of the first second expansion devices comprise:
a support member; and
a plurality of movable expansion elements coupled to the support member.

176. The apparatus of claim 175, further comprising:
an actuator coupled to the support member for moving the expansion elements between a first position and a second position;
wherein in the first position, the expansion elements do not engage the tubular member; and
wherein in the second position, the expansion elements engage the tubular member.

177. The apparatus of claim 176, further comprising:
a sensor coupled to the support member for sensing the internal diameter of the tubular member.

178. The apparatus of claim 177, wherein the sensor prevents the expansion elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value.

179. The apparatus of claim 176, wherein the expansion elements comprise:
a first set of expansion elements; and
a second set of expansion elements;
wherein the first set of expansion elements are interleaved with the second set of expansion elements.

180. The apparatus of claim 179, wherein in the first position, the first set of expansion elements are not axially aligned with the second set of expansion elements.

181. The apparatus of claim 179, wherein in the second position, the first set of expansion elements are axially aligned with the second set of expansion elements.

182. The apparatus of claim 142, wherein at least one of the first and second expansion

devices comprise a plurality of expansion devices.

183. The apparatus of claim 182, wherein at least one of the first and second expansion device comprise an adjustable expansion device.

184. The apparatus of claim 183, wherein the adjustable expansion device comprises:
a support member; and
a plurality of movable expansion elements coupled to the support member.

185. The apparatus of claim 184, further comprising:
an actuator coupled to the support member for moving the expansion elements between a first position and a second position;
wherein in the first position, the expansion elements do not engage the tubular member; and
wherein in the second position, the expansion elements engage the tubular member.

186. The apparatus of claim 185, further comprising:
a sensor coupled to the support member for sensing the internal diameter of the tubular member.

187. The apparatus of claim 186, wherein the sensor prevents the expansion elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value.

188. The apparatus of claim 185, wherein the expansion elements comprise:
a first set of expansion elements; and
a second set of expansion elements;
wherein the first set of expansion elements are interleaved with the second set of expansion elements.

189. The apparatus of claim 188, wherein in the first position, the first set of expansion elements are not axially aligned with the second set of expansion elements.

190. The apparatus of claim 188, wherein in the second position, the first set of expansion elements are axially aligned with the second set of expansion elements.

191. An apparatus for radially expanding and plastically deforming an expandable tubular

member, comprising:

a support member;

an expansion device for radially expanding and plastically deforming the tubular member coupled to the support member; and

a packer coupled to the support member.

192. The apparatus of claim 191, further comprising:
a gripping device for gripping the tubular member coupled to the support member.

193. The apparatus of claim 192, wherein the gripping device comprises a plurality of movable gripping elements.

194. The apparatus of claim 193, wherein the gripping elements are moveable in a radial direction relative to the support member.

195. The apparatus of claim 193, wherein the gripping elements are moveable in an axial direction relative to the support member.

196. The apparatus of claim 193, wherein the gripping elements are moveable in a radial and an axial direction relative to the support member.

197. The apparatus of claim 193, wherein the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in a radial and an axial direction relative to the support member.

198. The apparatus of claim 193, wherein the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in a radial direction relative to the support member.

199. The apparatus of claim 193, wherein the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not

engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in an axial direction relative to the support member.

200. The apparatus of claim 193, wherein, if the tubular member is displaced in a first axial direction, the gripping device grips the tubular member; and wherein, if the tubular member is displaced in a second axial direction, the gripping device does not grip the tubular member.

201. The apparatus of claim 193, wherein the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, the gripping elements are biased to remain in the first position.

202. The apparatus of claim 193, wherein the gripping device further comprises:

an actuator for moving the gripping elements from a first position to a second position;

wherein in the first position, the gripping elements do not engage the tubular member;

wherein in the second position, the gripping elements do engage the tubular member; and

wherein the actuator is a fluid powered actuator.

203. The apparatus of claim 191, further comprising:

a sealing device for sealing an interface with the tubular member coupled to the support member.

204. The apparatus of claim 203, wherein the sealing device seals an annulus defines between the support member and the tubular member.

205. The apparatus of claim 191, further comprising:

a locking device for locking the position of the tubular member relative to the support member.

206. The apparatus of claim 191, wherein the packer assembly comprises:

a packer; and

a packer control device for controlling the operation of the packer coupled to the support member.

207. The apparatus of claim 206, wherein the packer comprises:

a support member defining a passage;

a shoe comprising a float valve coupled to an end of the support member;

one or more compressible packer elements movably coupled to the support member; and

a sliding sleeve valve movably positioned within the passage of the support member.

208. The apparatus of claim 206, wherein the packer control device comprises:

a support member;

one or more drag blocks releasably coupled to the support member; and

a stinger coupled to the support member for engaging the packer.

209. The apparatus of claim 206, wherein the packer comprises:

a support member defining a passage;

a shoe comprising a float valve coupled to an end of the support member;

one or more compressible packer elements movably coupled to the support member; and

a sliding sleeve valve positioned within the passage of the support member; and

wherein the packer control device comprises:

a support member;

one or more drag blocks releasably coupled to the support member; and

a stinger coupled to the support member for engaging the sliding sleeve valve.

210. The apparatus of claim 191, further comprising:

an actuator for displacing the expansion device relative to the support member.

211. The apparatus of claim 210, wherein the actuator comprises:

a first actuator for pulling the expansion device; and

a second actuator for pushing the expansion device.

214. The apparatus of claim 210, wherein the actuator comprises means for transferring

torsional loads between the support member and the expansion device.

215. The apparatus of claim 211, wherein the first and second actuators comprise means for transferring torsional loads between the support member and the expansion device.

216. The apparatus of claim 210, wherein the actuator comprises a plurality of pistons positioned within corresponding piston chambers.

217. The apparatus of claim 191, further comprising a cutting device coupled to the support member for cutting the tubular member.

218. The apparatus of claim 217, wherein the cutting device comprises:
a support member; and
a plurality of movable cutting elements coupled to the support member.

219. The apparatus of claim 218, further comprising:
an actuator coupled to the support member for moving the cutting elements between a first position and a second position;
wherein in the first position, the cutting elements do not engage the tubular member; and
wherein in the second position, the cutting elements engage the tubular member.

220. The apparatus of claim 219, further comprising:
a sensor coupled to the support member for sensing the internal diameter of the tubular member.

221. The apparatus of claim 220, wherein the sensor prevents the cutting elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value.

222. The apparatus of claim 219, wherein the cutting elements comprise:
a first set of cutting elements; and
a second set of cutting elements;
wherein the first set of cutting elements are interleaved with the second set of cutting elements.

223. The apparatus of claim 222, wherein in the first position, the first set of cutting

elements are not axially aligned with the second set of cutting elements.

224. The apparatus of claim 222, wherein in the second position, the first set of cutting elements are axially aligned with the second set of cutting elements.

225. The apparatus of claim 191, wherein the expansion device comprises:
a support member; and
a plurality of movable expansion elements coupled to the support member.

226. The apparatus of claim 225, further comprising:
an actuator coupled to the support member for moving the expansion elements between a first position and a second position;
wherein in the first position, the expansion elements do not engage the tubular member; and
wherein in the second position, the expansion elements engage the tubular member.

227. The apparatus of claim 226, further comprising:
a sensor coupled to the support member for sensing the internal diameter of the tubular member.

228. The apparatus of claim 227, wherein the sensor prevents the expansion elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value.

229. The apparatus of claim 226, wherein the expansion elements comprise:
a first set of expansion elements; and
a second set of expansion elements;
wherein the first set of expansion elements are interleaved with the second set of expansion elements.

230. The apparatus of claim 229, wherein in the first position, the first set of expansion elements are not axially aligned with the second set of expansion elements.

231. The apparatus of claim 229, wherein in the second position, the first set of expansion elements are axially aligned with the second set of expansion elements.

232. The apparatus of claim 191, wherein the expansion device comprises an adjustable

expansion device.

233. The apparatus of claim 191, wherein the expansion device comprises a plurality of expansion devices.

234. The apparatus of claim 233, wherein at least one of the expansion devices comprises an adjustable expansion device.

235. The apparatus of claim 234, wherein the adjustable expansion device comprises:
a support member; and
a plurality of movable expansion elements coupled to the support member.

236. The apparatus of claim 235, further comprising:
an actuator coupled to the support member for moving the expansion elements between a first position and a second position;
wherein in the first position, the expansion elements do not engage the tubular member; and
wherein in the second position, the expansion elements engage the tubular member.

237. The apparatus of claim 236, further comprising:
a sensor coupled to the support member for sensing the internal diameter of the tubular member.

238. The apparatus of claim 237, wherein the sensor prevents the expansion elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value.

239. The apparatus of claim 236, wherein the expansion elements comprise:
a first set of expansion elements; and
a second set of expansion elements;
wherein the first set of expansion elements are interleaved with the second set of expansion elements.

240. The apparatus of claim 239, wherein in the first position, the first set of expansion elements are not axially aligned with the second set of expansion elements.

241. The apparatus of claim 239, wherein in the second position, the first set of expansion